Risk, time and social preferences

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RISK, TIME AND SOCIAL PREFERENCES: EVIDENCE FROM LARGE SCALE EXPERIMENTS

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1 Introduction

Modeling the way people make decisions in Economics builds upon assumptions regarding individual preferences. To better understand the underlying process of individual decision making, it is important to study the primitives of behavior, such as risk aversion, discounting and social preferences. Modeling individual preferences by means of economic experiments is the common motivation of this thesis. I study the connection between these preference measures and real economic behavior of subjects. These subjects participated in experiments that belong to a large representative panel of the Dutch population, the LISS Panel [1]. The first three chapters of this thesis focus on risk taking and time preferences. The last chapter studies the role of socioeconomic status on trust and reciprocity.

Why is it interesting to study preferences underlying economic decisions? This question is studied in the first three chapters of the thesis. In many areas, individual financial choices play an important role. For example, in the Netherlands, the number of self-employed people has increased [2] and, therefore, the responsibility of saving for retirement falls into their own hands. Likewise, the transition of pension schemes from “defined benefit" to “defined contribution" shifts the risks to pension participants. Under these new pension schemes, households need to decide whether to increase their savings to compensate for the decrease in future pension income. This leads to the following more general questions: How are financial choices within a household being made? If a household is composed of more than one individual, which family members decide and what influences their decisions? Are individual preferences stable over time? These questions are approached by using experimental data and information on actual

[1] The LISS panel (Longitudinal Internet Studies for the Social sciences) consists of approximately 8000 individuals. The panel is based on a true probability sample of households drawn from the population register by Statistics Netherlands

[2] Statistics Netherlands (CBS), Werkzame beroepsbevolking; meer of minder willen werken. Retrieved from statline.cbs.nl

financial choices such as household portfolio composition and financial wealth.

Not only risk and time preferences have an influence on economic outcomes, but also social preferences are important. In the last chapter, I focus on studying the relationship between trust and reciprocity with socioeconomic status. There is evidence showing that trust has a positive relationship with economic growth since it lowers transaction costs and increases cooperation (Knack and Keefer, 1997). Although trust depends highly on the institutional environment of a given society (as shown by cross-country studies, Falk et al. (2015)), demographic characteristics such as age, ethnicity, socioeconomic status or gender can play a role. For instance, Dohmen et al. (2008) find that being female is related to stronger reciprocal tendencies. Glaeser et al. (2000) find that differences in race or nationality are related to less reciprocity.

To have a better understanding of the main notions of this thesis, I explain how some concepts of the literature on economic preferences are defined.

Risk aversion

Risk aversion refers to the distaste of individuals towards options that have certain degree of risk in their outcomes. These outcomes have a wide range, for example, risk related to health-related choices (smoking), sports and leisure activities (sky-diving, driving) or financial decisions. Why do people prefer to have large amounts of savings in the instead of investing these savings? The formal definition of risk aversion dates back to von Neumann and Morgenstern's Theory of Games and Economic Behavior (1954). Later, the seminal work of Arrow (1971) and Pratt (1964) laid down the foundations of measuring the attitude towards risk as the curvature of the utility function. Since then, the literature has developed to account for the observed heterogeneity in behavior with respect to risk. For example, Moffat (2005) proposed a random coefficients mixed model to classify people into expected utility or rank dependent expected utility theory. One important method of elicitation of risk aversion is the so called *Multiple price list* method which consists of inferring the curvature of the utility function from choices between lottery options. As will be shown in the next chapters, we build upon this method to construct a modified version that takes into account different timing of the payoffs.

Time discounting

The difference in valuation of money or consumption between different time periods is related to what is called the discount rate or time preference. For example, it is common in the experimental literature to elicit this discount rate by observing the amount of money it takes

for someone to delay immediate payoffs at different time periods (Frederick, Loewenstein and O'Donoghue, 2002). Let's assume that somebody would need 110 euros in one month in order to forego a payoff of 100 euros today. This would imply a 10% monthly discount rate. The literature on this topic has identified certain aspects of discounting which better capture behavior, such as non-linear discounting (*exponential*), time-inconsistent discount rates (*hyperbolic discounting*) and other more flexible specifications of the discounting function (*quasi-hyperbolic*). Throughout the next three chapters of this thesis, we will be talking about time discounting together with risk aversion (which we elicited through a lottery task involving both risk and time delays).

Trust and trustworthiness

When studying the social environment where economic transactions take place, trust has a central role in explaining behavior, which deviates from economic models based on self-interested individuals. Trust and trustworthiness are related to each other but describe the behavior of two different roles in a given transaction that involves some uncertainty. Trust is expressed by the person who decides to, for example, transfer money to another person with some expectations of future returns. Trustworthiness describes the behavior of the second person who decides whether to reciprocate to the person who trusted him or her and by doing so, increasing the returns of the trustors. In other words, trustworthiness describes how much a person is worth trusting. Trust has been seen to vary across countries (at the macro-level) and across individuals (at the micro-level), this heterogeneity can sometimes be explained by differences in institutions and the economic environment. In the last chapter of this thesis, I explore whether socioeconomic status can be related to the level of trust and trustworthiness at the individual level.

Structure of the thesis:

Chapter 2 focuses on the analysis of risk and time preferences at the individual level. To study these preferences we constructed an experiment in which we measured these attitudes with a modified multiple price list lottery design and additionally with stated preference survey questionnaires. Based on choices between lotteries, we used this data to fit structural parameters of utility taking into account sociodemographic background variables. The econometric specification accounted for observed and unobserved heterogeneity in risk and time preference parameters as well as in the tendency to make suboptimal choices. We take into consideration insights

from literature in psychology which shows some personality traits are important for economic success (Almulund et al., 2014; Rustichini et al., 2016; Becker et al., 2012; Borghans et al., 2006). So far, most studies have tried to link and look at correlations between economic preferences and personality traits and some of them suggest that personality traits might explain better the variation in economic behavior (Rustichini et al., 2016). We contribute to this literature by studying the association between traits and economic preferences, and focus especially on their influence on individuals' portfolio choices. We test whether personality traits have a direct or indirect effect on portfolio choice when controlling for economic preferences of risk aversion and discounting.

As opposed to the study of Rustichini et al, we find that the channels through which personality affects behavior are different from those measured by economic preferences (even if these are significantly correlated with each other). We also find strong correlations between our individual predictions of risk aversion and discounting with the traits Agreeableness and Intellect/Openness. When we study financial decisions, e.g., investment in risky assets, we find that economic preferences are more predictive than psychological traits. We also find that the trait Conscientiousness is not correlated to our predictions of economic preferences, but it is significant in predicting accumulated financial wealth. Our results therefore point towards complementarity rather than substitution of economic preferences and personality traits in explaining economic outcomes.

As mentioned before, it is important to understand not only how individuals choose how much to save or invest, but also how these choices reflect preferences of different household members. Imagine the life expectancy of a wife being much higher than the life expectancy of her husband. Does this create different incentives to save? However, it is not clear whether different incentives or different tastes translate into a strategy that is beneficial to all parties. There is ongoing literature which tries to open this "black box" of household decision making and looks at it from the perspective of game theoretic bargaining models (Vermeulen, 2002). However, bargaining with respect to decisions which might be less frequent and involve different levels of risk, such as how much to save or whether to invest in other type of assets has not been so widely explored in the literature.

Chapter 3 continues the analysis on financial decision making and economic preferences when households consist of two people or more. We focus on the interaction between preferences of spouses either married or living together. In empirical studies, the decision process within households is overlooked since as researchers we cannot often observe how people divide

tasks or negotiate at home. However, it is not straightforward why we would assume spouses to have the same preferences with respect to risk taking if, for example, a robust result in the literature of risk aversion is that women are significantly more risk averse than men (Croson and Gneezy, 2009) and therefore might prefer investments in safer assets. We study whether risk aversion and discounting are similar within the couple and how this results in different bargaining scenarios and insights into their actual portfolio decisions. From literature on socialization and economic preferences, researchers have found positive correlations between couple's risk and trust attitudes (Dohmen et al., 2012; Bacon et al., 2014) or no correlation (Abdellaoui et al., 2013). We go further and perform a reduced form analysis, which incorporates bargaining with respect to economic preferences. We find that the husband's risk aversion coefficient is more influential in the household decision to invest in risky assets than the wife's if we do not control for bargaining power. Both time preference parameters are significant in predicting the level of financial wealth a household has accumulated. We find that the bargaining power with respect to risky and intertemporal choices is not always equally divided within couples. Furthermore, controlling for the bargaining position of spouses helps to predict household saving decisions from the preferences of the two individuals.

Chapter 4 approaches the following questions: Are preferences stable? Can financial shocks have an effect on preferences? Do these effects affect the preferences of their spouses? Economic models often rely on the assumption that preferences are rather stable over time. This allows us to identify causal effects of changes in behavior as a result of changes in relative prices or policies. Some studies have found that time and risk preferences are stable across time periods (Wölbert and Riedl, 2013; Andersen et al., 2008; Falk et al., 2016) but the amount of stability shown depends on the elicitation method and noise which is captured by the respective measures. Given that we have estimated measures of preferences, we seek to understand whether these can also be stable across time and whether temporary shocks to their employment or financial expectations are correlated to changes in preferences. We compare the level of stability that we can capture with experimental measures and that of survey questions. In line with previous literature, we find that survey measures are more stable (due to less noise) than experimental measures (Chuang and Schechter, 2015).

We used a second wave of experimental choice data and qualitative survey questions to analyze the stability of risk and time preferences at the individual level and to study cross-spousal effects in couples. We constructed a structural model of preferences at the individual level for two different time periods. We found small positive correlations between time periods.

The main novelty of our approach is that we explore not only individual channels of temporal instability but also possible effects through the spouses. Using fixed effects models explaining the experimental measures from (changes in) individual and partner health, occupational and financial status, we find, for example, positive associations between the husband's impatience and a transition of either the husband or the wife into non-employment due to work disability. Additionally, we find that several variables are associated with the tendency to make suboptimal decisions. Using the stated preference indexes of risk aversion and time preference leads to substantially different results.

Finally, *Chapter 5* introduces two new topics which are related to social preferences; namely, trust and trustworthiness (which we also refer to as reciprocity). Using experimental methods, it is possible to control for the amount of information being shared during a transaction and study people's motivations and preferences. Previous research has shown that high status in a group (Ball et al., 2001) or in high socioeconomic status (Falk and Zehnder, 2013) can result in higher payoffs to these groups or socioeconomic classes. However, when the only information available is, for example, a name, how do people process this information? Is it possible to infer their socioeconomic status from it? Examples where people sometimes only observe names in transactions and involve a degree of trust and reciprocity can be services like Uber, Airbnb and Ebay, among others.

We study the effect of social status and social status differences on trust and trustworthiness in a representative sample of the Dutch population. We do not find social status of the matched participant to be an important factor in the decision to trust or reciprocate. Instead, trustworthiness is related with own social status as well as with differences in status: trustees with high social status, or trustees whose social status is very different from that of the matched trustor, reciprocate more often. With respect to trust, we find no such effect.

2 | Economic preferences and personality traits on portfolio choice outcomes

2.1 Introduction

The study of individual behavior has been the interest of economics because its potential outcomes on the economic welfare. At the core of economic decisions, economists study the way in which individuals take risks and their motivations of saving for future consumption. A common way to study these decisions is by modeling the economic preferences of the individual (estimating parameters of risk and time preference[1]). Another alternative way to study economic decisions has been approached from Psychology based on Personality Theory. Within this perspective, psychologists have identified five different factors involved in this process of decision making: namely, Agreeableness, Openness/Intellect, Neuroticism, Conscientiousness and Extraversion. Many authors have intended to mix these two kinds of approaches, the economic and the psychological to understand the process of decision making in economics. However, the way in which they predict economic decisions is not yet conclusive. For instance, an open question is whether personality shapes economic preferences or whether these two capture different dimensions through different channels that impact particular outcomes. Heckman et al. (2006) motivate that “Common sense suggests that personality traits, persistence, motivation, and charm matter for success in life".

In this paper, we seek to understand how measures of economic preferences relate to mea-

[1]For example, assuming certain parametric functions of utility and discounting.

sures of personality. In particular, we observe how these are related and how both of them influence real economic decisions. The real economic decisions we study are self-reported Portfolio choices. We focus on measures of risk aversion and time preferences [2]. Other economic outcomes related to these preferences are the decision to buy life insurance, the inclination to a riskier career path with higher expected income growth or a secure job, the decision to invest in education, among others. These choices involve different levels of risk and uncertainty about present and future outcomes. If personality traits affect the way in which people make financial decisions, we expect these to be correlated to our suggested measures of risk aversion and impatience. Understanding this relationship better could help policymakers design policies directed at improving the economic welfare of individuals and society. For example, interventions aimed at improving personality traits of young children have proven to be beneficial at later stages of their life (Heckman et al., 2010, 2006).

Roberts and Mroczek (2008) define personality traits as "the relatively enduring patterns of thoughts, feelings, and behaviors that distinguish individuals from one another". Personality measures may help economists understand and explore new dimensions of behavior that can potentially explain patterns, inconsistencies and irrationalities often observed in decision making in economics. Part of the literature has already looked at correlations between measures of personality traits and economic or educational outcomes. For example, Almulund et al. (2014) shows that conscientiousness can predict educational attainment and job performance. This trait captures the ability to exert control over behavior in order to pursue future goals. Theoretically, we would expect this trait to be negatively correlated with the discount rate. Rustichini et al. (2016) find that Openness/Intellect trait, which is normally related to general intelligence, has a strong positive effect on credit score and job persistence. Personality could also influence the duration of unemployment or occupational choice, which would in turn have an impact on economic success. Dohmen et al. (2010) find no correlation between personality traits and risk aversion or impatience. Other studies include personality traits to control for unobserved heterogeneity such as Choi et al. (2014), who find a correlation (although not statistically significant) between Conscientiousness and economic success (wealth).

Our study is similar to Rustichini et al. (2016) and Becker et al. (2012) where they analyze correlations between personality, preferences and life outcomes (life satisfaction, health, labor

[2]The literature on risk aversion dates back to von Neuman and Morgenstern's Theory of Games and Economic Behavior (1954). Later the seminal work of Arrow (1971) and Pratt (1964) provided de foundations for measuring risk attitudes based on the curvature of the utility function.

market success, credit score and truck accidents). However, we contribute to the literature not only by repeating the exercise of studying correlations of both measures and comparing to existing findings, but we additionally study other economic outcomes, such as investment decisions and financial wealth accumulation. Also, in our study, we add a measure of decision-making error. Methodologically, we also differ in the type of samples used to elicit preferences. While Rustichini et al. (2016) focus on truck drivers and Becker et al. (2012) compare a sample of student and non-student samples, we obtain a large adult sample. We also differ in the methodology for eliciting preferences and show that an integrated lottery method can identify both risk and time preferences jointly.

We contribute to this literature by studying the association between traits and economic preferences, and focus especially on their influence on individuals' portfolio choices. We test whether personality traits have a direct or indirect effect on portfolio choice when controlling for economic preferences of risk aversion and discounting.

We carried out a lottery experiment in the LISS panel, which is an Internet survey panel representative of the Dutch adult population[3]. This method is based on previous methods which make use of lotteries, specifically the method used by Holt and Laury (2002). Since our main interest lies in estimating parameters that we can use to model decision making in a structural way, we show, with different specifications, how we can estimate parameters of risk aversion and time discounting (impatience). Previous research has shown that estimating risk aversion and time preferences jointly can significantly improve the discount rate estimates. Andersen et al. (2008) find that joint estimation of these two parameters provides estimates of discount rates that are significantly lower than those found in other studies where estimation is done separately. The estimation of the curvature of the utility function and computation of time preference parameters jointly is now an active topic of research (Ventura, 2003; Voors et al., 2012; Andreoni and Sprenger, 2012a; Potters et al., 2016). The main difference between our method and that by Andersen et al. (2008) is that we elicit preferences in the same task (as opposed to splitting risk elicitation from time preference elicitation). Using a structural model with random coefficients to account for heterogeneity in risk and time preferences, we estimate individual level parameters for risk and time preference. Participants had to make 20 choices which varied in risk and timing of the payments. With these choices, we constructed a structural model of utility including parameters of risk and time preference jointly. We offered real monetary incentives of one randomly chosen choice with 10% probability.

[3]See www.lissdata.nl

The data we used to construct the Big-5 personality traits corresponded to the same individuals who participated in our experiment that same year[4]. We also made use of the rich background information available in the panel to control for observed background characteristics. We controlled for these when studying the effects of both preferences and psychological traits on financial outcomes.

We find some patterns of correlations between economic preferences and personality traits as measured by the Big-5. We find that the experimental measure of risk aversion is positively correlated with Agreeableness and Conscientiousness and negatively with Openness/Intellect. Impatience and the tendency to make suboptimal choices are negatively correlated to Openness/Intellect. We expected such a relationship since Openness is closely related to different measures of cognitive ability according to the literature (Ackerman and Heggestad, 1997; DeYoung et al., 2011).

Preferences for risk and discounting have a clear correlation to investment and savings decisions. On the other hand, most dimensions of personality have no direct effect on these financial decisions. We find that our experimental measures of risk aversion, impatience and error propensity significantly contribute to explaining portfolio choice and accumulated financial wealth. We find a significant and negative association between risk aversion and the propensity to own risky assets. An increase in the parameter capturing the tendency to make suboptimal choices also lowers the likelihood of owning risky assets. The experimental impatience measure is negatively associated with the amount of financial wealth of individuals. Finally, as a robustness check we use alternative measures of risk taking and impatience based on qualitative self-assessment, we find the same direction of correlations as with the experimental predictions.

We do not find an indirect effect of personality traits on financial decision making. The correlations between personality traits and outcomes are robust to including economic preferences in the model. Hence, when we include preferences together with psychological traits to explain economic outcomes, e.g., ownership of risky assets, most of the traits are not statistically significant. Agreeableness is marginally significant in the propensity to own risky assets and Conscientiousness is highly significant in predicting accumulated financial wealth. Preferences and personality apparently have different effects on economic outcomes.

Aside from personality, other important determinants of economic success that are related to learning and mathematical abilities, are cognitive ability and financial literacy. These abilities

[4]Source: Core study on Personality.

are key in explaining why some people, e.g., choose to invest in risky assets, save or decide to take on more debt (Lusardi, 2008; Van Rooij et al., 2011). Therefore, in addition to individual specific parameters for risk aversion and time preference, our structural model also has an individual specific measure for the tendency to make suboptimal decisions: the standard deviation of the Fechner error in the individual's binary choices. Following the recent literature to take errors in decision making seriously (Loomes, 2005; Andersen et al., 2008; Von Gaudecker et al., 2011), we consider this parameter as a third "economic" characteristic of the individual. It is informative of unobserved characteristics such as numerical ability or motivation. Similarly, to the two preference parameters, we also investigate how this error tendency parameter relates to personality traits and economic outcomes.

In section 2.2 we describe in detail the experimental design along with the specification of the individual level preference parameters and in section 2.3, the data description. In section 2.4 we show the results from the correlations between preferences and personality traits and their relationship with portfolio choice and financial wealth accumulation outcomes. Finally, we conclude in 2.5 and point towards future research applications.

2.2 Experiment and individual preferences

The experiment

Following the methodology of Holt and Laury (2002) and similar to Von Gaudecker et al. (2011), we designed a modified Multiple Price List. The experiment consisted of four separate tasks, each including five choices. Therefore, each subject provides 20 binary choices which are used to infer risk and time preferences. Additional to these tasks, we included qualitative questions of self-evaluation of risk taking and impatience.

The experimental procedure was as following. Subjects first faced a screen with instructions to the experiment and payment specifications which were then followed by an example of a binary choice. After these introductory screens, the first screen containing five lottery choices was shown. Subjects were only allowed to continue once they had filled all five questions. It was also allowed to return to previous screens or instructions if necessary. At the end of the experiment, it was revealed to the participants whether they were selected for payment, and one

of their choices was randomly realized and paid as described in the instructions[5].

In every screen, each individual had to choose five times between two lotteries which varied in probabilities but did not vary in the payoffs. Lottery A and B differed in the variance of the payoffs. Typically, lottery A offered the least variance. Hence, the expected value of the riskier lottery B increased as subjects scrolled down the list. The modification we introduced to the MPL method, is that we varied the timing of the payouts in the following way: immediate or delayed 3, 6 or 9 months. Table 4.7 in the appendix shows the experimental design in detail – the probabilities, the amounts, and the timing of payments for each choice option in each treatment. Typically, the switching point is then an indicator of the individual's risk aversion: more risk averse individuals would switch later. In our design, the interpretation of the switching point combines the taste for risk as well as impatience.

In summary, the payoff structure was the following. We informed the subjects at the beginning of the experiment that they had a probability 10% of actual payment; at the end of the experiment, they were informed whether they were selected for real payment or not. The literature has demonstrated that this is a good strategy to keep the tasks incentive compatible and simultaneously limit the costs for the experimenter (Dohmen et al., 2010). Conditional on being selected for payment, the average payoffs were 13.4 euros with a standard deviation of approximately 7 euros. The participation fee is calculated according to the expected time it takes to fill in the questionnaire. Therefore, we paid subjects 2.50 as participation fee for a duration of the experiment of approximately 10 minutes[6].

The key aspect of this design is that the choice lists have enough variation in risk and timing of payoffs to allow us to accurately predict individual preference parameters. Before taking the experiment to the field, we ran simulations assuming a structural form of the utility function and discounting to ensure that this was indeed the case. In Figure 3.4 we present an example of one of the lottery choices of the first part of a screen that subjects faced during one of the treatments. Each screen contained five choices and pie charts illustrating the probabilities, following Von Gaudecker et al. (2011). Under options A and B we denoted in red text the timing of the payment. Since there is no experimenter present in an online experiment, we allowed participants to switch back to a previous choice or to read the instructions, and to change previous choices if they wanted to.

[5]The instructions and examples of the experiment are included in the Appendix 2.5

[6]The median duration of the experiment was 9.35. The participation fee is standard of the LISS panel for participation in regular surveys, the calculation is based on 15 euro per hour.

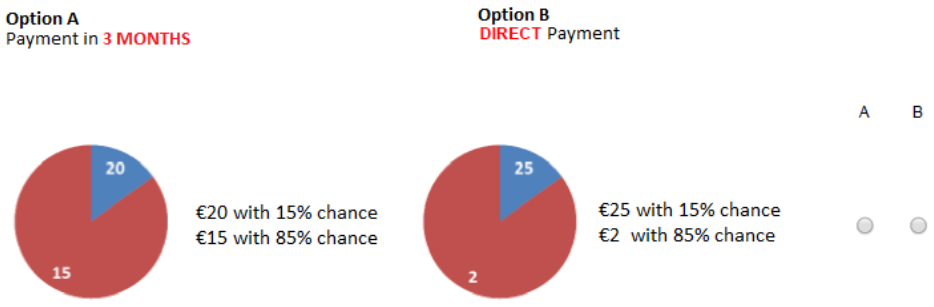


Figure 2.1: Screen shot example of one choice

Even though we included pie charts to help participants understand the trade-offs graphically, we observed some inconsistencies. One type of inconsistency in behavior that can arise in this type of elicitation method is multiple switching between options A and B: If a person switches from a safer lottery to a riskier one and then decided to switch back to a safer lottery, that individual is not choosing according to maximizing a smooth (concave or convex) expected utility function or according to one of the standard generalizations of expected utility maximization. Following, for example, Von Gaudecker et al. (2011), we deliberately chose not to enforce a single switching point when designing our experiment, so that we can incorporate possible inconsistencies and errors into the decision making model.

Another possible inconsistency was the possibility of choosing dominated options. In every screen, the last lottery choice involved a dominated option. For example, in choice 5 of treatment 1, subjects could earn either 20 euros with 100% probability or 25 euros with 100% probability. If a subject would choose the certain amount in option A, we would classify her as picking a dominated choice. This implied she preferred less money with certainty to more money with certainty, which would violate monotonicity of the utility function. In the next section we show the percentage of people who display either multiple switching or dominance errors. In some cases, if an individual was, e.g., infinitely impatient (and lottery A had the "sooner" payout), this dominated choice would not necessarily imply an inconsistency. This is why, as we will describe in the next sections, we do not eliminate these observations from our sample.

Finally, after the lottery tasks were completed, we included questions to gather self-assessed qualitative measures of risk taking (in different domains) and impatience. These types of preference elicitations were not incentivized and therefore might or might not capture true preferences

(Charness et al., 2013). However, studies using the same survey questions to elicit risk taking in different domains have been performed in large scale panels (Dohmen et al., 2011, 2005), showing that this method provides a measure of risk attitudes that correlates well with actual decision-making under risk. Based on the literature so far, we consider that these types of elicitation procedures can be useful depending on the research question and context. We extended these studies by also qualitatively measuring time preferences with a question on impatience to spend money.

The risk questions which we included are standard in the literature of risk elicitation and are the following:

- How do you see yourself? Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please give a value between 0 and 10, with 0 for “not at all willing to take risks" and 10 for “very willing to take risks".
  - How would you rate your willingness to take risks concerning financial matters?
  - your willingness to take risks... - in your occupation?
  - your willingness to take risks... - during leisure and sport?

To measure stated time preference or discounting, we included the following questions[7]:

- On a scale from 0 to 10, how patient do you consider yourself to be? (10 being the most patient value)
- How much do you agree with the following: If I get money I tend to spend it too quickly (on a scale from 0 strongly disagree to 10 fully agree).

Utility specification and random coefficients model

Following an empirical strategy similar to that of Von Gaudecker et al. (2011), we included parameters of utility curvature (risk aversion) and time preference from a quasi-hyperbolic discount function. We also allowed for heterogeneity in the tendency to make suboptimal decisions

[7]Similar formulations were included in surveys before, for example in the German SOEP 2008 and validated by Vischer et al. (2013). Charness and Viceisza (2015) uses these in a field experiment in rural Senegal. The second question relates to impulsiveness and impatience and was taken from Jamison et al. (2012).

by including Fechner errors with a variance that varies across participants. We show the results for the CARA utility (exponential) function which does not encounter problems around 0 as do typically CRRA functions (Köbberling and Wakker, 2005). This is useful given that our monetary incentives are not high. The specification we use is as follows:

Utility function:

$$U(\gamma, z) = \frac{1}{\gamma}(1 - e^{-\gamma z}) \tag{2.1}$$

where $\gamma \in \mathbb{R}$ is the coefficient of absolute risk aversion. The monetary payoff of the lotteries is denoted by $z \in \mathbb{R}$. We do not include background wealth or consumption in our specification. This assumption is based on the work by Noussair et al. (2014). They found evidence of increasing relative risk aversion of a sample of the LISS panel. CARA utility function has been proposed as an alternative (opposed to CRRA). With our data, we confirm that a CARA utility function fits better than the model using CRRA. One of the properties of such a utility function is that adding a fixed amount of money (as for example, income or wealth), does not affect the choice outcome. Also, the stakes which we offer in our experiment are not large enough to have a significant impact on people's wealth.

Discounting function:

$$D(r,t) = e^{-rt} \tag{2.2}$$

where r is the discount rate (note that when $t = 0$ this term becomes 1). We tested other specifications such as hyperbolic and quasi-hyperbolic discounting to account for present bias. However, the model which best fit the data was the one with the exponential discounting function. This is similar to what Andreoni and Sprenger (2012b) found in their estimation of time preferences using the convex time budget method.

Discounted expected utility (DEU):

$$DEU = D(r,t) * U(\gamma, z) \tag{2.3}$$

We assume respondents choose the lottery which maximizes their discounted expected util-

ity (DEU) plus Fechner error $\tau\varepsilon$. Therefore a subject will choose lottery B if:

$$DEU^B + \tau\varepsilon_B > DEU^A + \tau\varepsilon_A \tag{2.4}$$

where the ε's follow a type I extreme value distribution and are independent of each other. The difference of the errors $\varepsilon = \varepsilon_A - \varepsilon_B$ follows a logistic distribution. The parameter τ can be interpreted as the tendency of making a suboptimal choice.

Let us denote the difference between the DEU of option A and the DEU of option B for individual i in choice problem j as:

$$\Delta DEU_{ij} = DEU_{ij}^B - DEU_{ij}^A \tag{2.5}$$

If an individual chooses option B, $Y_{ij} = 1$ and it is zero otherwise. Then:

$$Y_{ij} = \mathbb{I}\{\Delta DEU_{ij} > \tau_i\varepsilon_{ij}\} \tag{2.6}$$

We use a random coefficients model with three individual specific parameters, γ, r and τ, that are allowed to depend on observed and unobserved characteristics. Previous studies have found that observed characteristics are rather poor predictors of risk attitudes, which is why we also introduced unobserved heterogeneity parameters (Von Gaudecker et al., 2011). The three random coefficients are captured by a vector $\eta_i = (\gamma_i, ln(r_i), ln(\tau_i))'$. The logarithm is taken to guarantee that $r > 0$ and $\tau > 0$.

For respondent i with given observed characteristics X_i, we assume η_i is drawn from a three-variate normal distribution with arbitrary covariance matrix and means that are linear combinations of the components of X_i:

$$\eta_i^s = X_i\mu^s + \xi_i, s = 1,2,3 \tag{2.7}$$

We assume that the vector ξ_i is drawn from a three-variate normal distribution, independent of all regressors. The variance covariance matrix of ξ_i is $\Sigma'\Sigma$ and we define $\xi^* = (\Sigma')^{-1}\xi$.

We estimate the model using simulated maximum likelihood (SMLE). The individual's conditional likelihood to observe choice Y_{ij} given the individual specific parameters $\eta = (\gamma, \ln(r), \ln(\tau))$ is given by:

$$l_{ij}(\eta) = \Lambda\left((2Y_{ij}-1)\frac{\Delta DEU_{ij}(\gamma,r)}{\tau}\right) \tag{2.8}$$

where $\Lambda(\cdot)$ is the cumulative standard logistic distribution function.

The unconditional likelihood contribution of subject i can be written as:

$$l_i = \int_{\mathbb{R}^3} \prod_{j\in J_i} l_{ij}\big(\eta(\xi^*)\phi(\xi^*)\big)d\xi^* \tag{2.9}$$

where $l_{ij}(\eta)$ is the conditional likelihood given in (2.8) and $\phi(\cdot)$ denotes the three dimensional standard normal probability density function. The loglikelihood is given by the sum of the individual contributions of l_i over all subjects. To approximate the integral above we use simulation with Halton draws of length R=200 for each individual[8]. The variance covariance matrix of the parameter estimates is based on the outer product of the gradients of the logarithm in (2.8).

Using the estimated model parameters and the individual choices Y_{ij}, the ("posterior") distribution of the random coefficients η_i given X_i and the Y_{ij} can be determined using Bayes rule. Its density is given by:

$$P(\eta_i|y_i,X_i) = \frac{P(y_i|\eta,X_i)k(\eta,X_i)}{l(y_i,X_i)} \tag{2.10}$$

Here $l(y_i,X_i)$ is the likelihood contribution of individual i, integrating out the unobserved heterogeneity parameters. $k(\eta,X_i)$ is the estimated density of the "prior" distribution of η_i given X_i, which we assumed to be multivariate normal. $P(y_i|\eta,X_i)$ is the probability of observing choice sequence y_i given η,X_i. The mean of the posterior distribution gives the vector of predicted individual level parameters. In the empirical analysis below, these predicted parameters are used as indicators of risk aversion, time preference, and error propensity for each individual.

[8]We used Matlab to program the Likelihood function and Knitro package for the optimization procedure which uses the BFGS algorithm. The Halton draws were programmed in Matlab (Beusch, 2015), but are equivalent to *mdraws* command from STATA. The prime numbers used were 3, 7 and 17. More recently, Zeng (2016) shows that it is not necessary to increase the number of Halton draws when the sample size increases. Our sample size is relatively big and we do not have more than three integration dimensions, therefore, we considered 200 Halton draws to be more than enough to obtain precise estimates.

2.3 The data

We performed an incentivized experiment in the LISS panel, administered by CentERdata at Tilburg University; see, e.g., Scherpenzeel (2011). The LISS panel is an ongoing Internet survey in which participants are invited irrespective of whether they have access to Internet or not; if necessary CentERdata provides them with a simple personal computer with limited functionality and Internet access to the survey. Participants are asked to answer different types of survey modules every month and receive monetary compensation for this through amounts regularly transferred to their bank accounts. The panel contains rich information on demographic variables and many other socio-economic topics, including the respondents' self-reported financial situation. The survey took place in the wave of April 2014 and background characteristics belong to that same year.

Table 2.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Female	0.501	0.500	0	1	2825
Position in the household	1.598	0.667	1	6	2825
Age	52.041	14.935	18	91	2825
High education	0.345	0.476	0	1	2825
Married	0.804	0.397	0	1	2825
Number of kids	0.824	1.098	0	6	2825
Financial literacy	2.398	1.028	0	4	1697
Numeracy	8.548	2.488	0	11	1477
Civil servant	0.007	0.082	0	1	2778
Self employed	0.055	0.227	0	1	2825
Investments	0.140	0.347	0	1	2534
Financial wealth	22355.236	68342.296	-90000	1300000	2530
Total wealth	17671.429	76099.509	-940000	1300000	2530

Notes: Means and standard deviations of characteristics of participants in the lottery experiment of the final sample.

Table 2.1 presents the sample statistics of sociodemographic variables of the final sample. The last three rows are of special interest, since we use information on their financial matters to study the relationship between preferences, traits and financial decision-making. In our experiment we target those households which consist of two adults who live together (married or unmarried) and in which both household members participate in the survey[9]. Table 3.8 shows the descriptive statistics of each of the four treatments. In total, we have a sample of 3,007 individuals who finished the experiment and our final sample consists of 2825 individuals due to

[9]This selection was done to investigate couple decision making in a follow up study (Chapter 3 of this thesis)

missing information and exclusion of some people who made inconsistent choices (as described next).

From the lottery tasks we counted how many risky choices each respondent made and how many “impatient" choices they picked that involved an earlier payoff than the alternative. In table 3.8 we show the proportion of people choosing option B, which is always riskier than option A. From this table we already see, as expected, that when people go down the list, they switch from A to B reflecting their risk aversion. However, the preference for immediate rewards is not easily visible from these proportions and requires more detailed analysis.

Table 2.2: Summary Statistics of Choices

Screen	Choice	Mean	Std. Dev.	Screen	Choice	Mean	Std. Dev.
1	1	0.2161	0.4116	3	1	0.1912	0.3933
	2	0.2429	0.4289		2	0.1985	0.3989
	3	0.4362	0.4960		3	0.2795	0.4488
	4	0.6881	0.4633		4	0.5045	0.5001
	5	0.8691	0.3374		5	0.8167	0.3870
2	1	0.3401	0.4738	4	1	0.1985	0.3989
	2	0.4242	0.4943		2	0.2302	0.4210
	3	0.6609	0.4735		3	0.4142	0.4927
	4	0.8146	0.3887		4	0.6602	0.4737
	5	0.9001	0.2999		5	0.8342	0.3719

Notes: Means and standard deviations of each choice across the four conditions of the experiment.

As is visible from Table 3.8, there is a proportion of the population that chooses the dominated option which is presented in each treatment. This implies that people chose to receive a lower amount with certainty instead of a higher amount. This could indicate a violation of monotonicity in preferences. However, we have to take into account the interaction with the delays in payment. For example, if a person is infinitely impatient, she might prefer the lower payment because it will be delivered sooner. On the other hand, if that same person later picks a dominated choice when the lower amount is delivered sooner, this would be clearly inconsistent. Figure 2.2 shows the percentages of the number of dominated choices. More than half of the sample never picks the dominated choice and approximately 4% of the sample always picks the dominated choice in each treatment. Dominance errors are not uncommon in the literature of risk elicitation in multiple price lists of non-student populations (Von Gaudecker et al., 2011; Charness et al., 2013).

For the rest of the analysis we did not include the 133 people who always picked the dom-

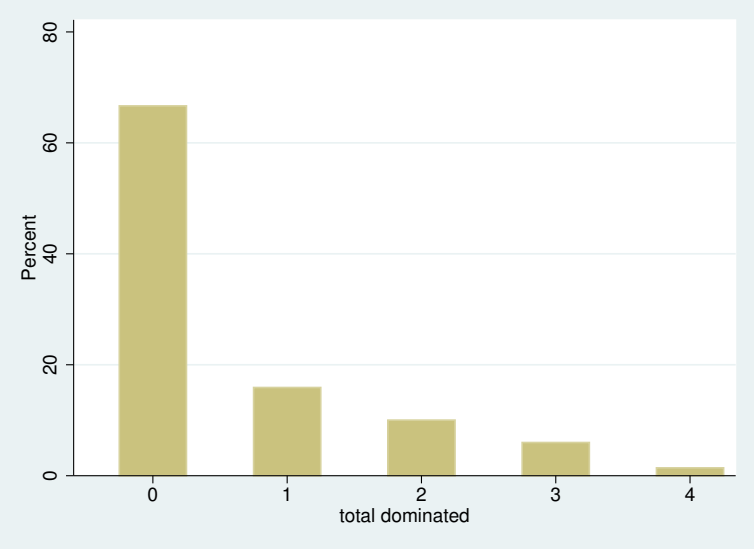


Figure 2.2: Dominated choices

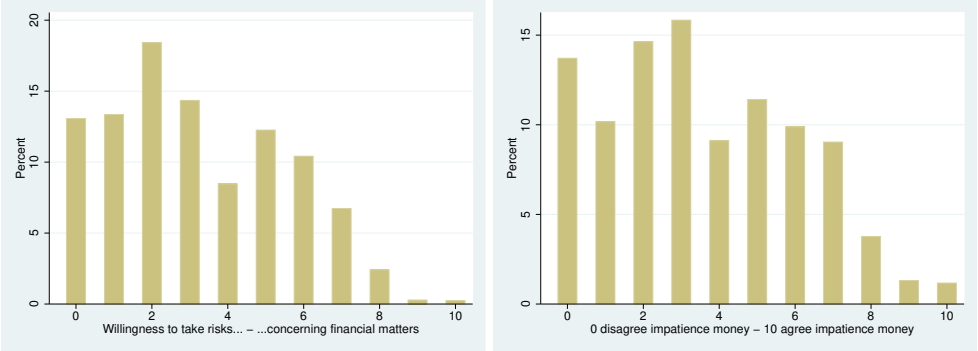
inated option since they are people who did not understand the task or did not put any mental effort into it. In Table 2.10 of the Appendix, we show the background characteristics of this group. We found that on average this sub-sample is significantly older and less educated. Since this is only 4.42% of the sample we decided to exclude them from the sample along with individuals for which we do not have data on background characteristics, such as age or level of education. Our final sample consists of 2825 individuals.

Figure 2.3 shows the distribution of responses to the stated subjective preference measures. We observe that people in our sample assess themselves typically as quite risk averse, with the distribution skewed to the right. Subjects also claim to be patient with respect to their tendency to spending money too quickly.

Individual preferences towards risk and time

The results of the estimation of the structural utility model of CARA and exponential discounting function are presented in Table 2.3[10]. The second and third columns present the estimations without the inclusion of unobserved heterogeneity. The last two columns present the complete model. As shown in the Table, the variances of the unobserved heterogeneity terms are also

[10]We also experimented with a CRRA utility function with quasi-hyperbolic and hyperbolic discounting. This model always gives a worse goodness of fit than the model with CARA preferences.



(a) Willingness to take risk (b) Patience spending money

Figure 2.3: Stated preferences

significantly different from zero.

We find negative relationship between risk aversion and education and we find that women are more risk averse than men, on average. This result has been repeatedly reported in the literature (Croson and Gneezy, 2009; Eckel and Grossman, 2008). Older people exhibit more risk aversion, as also found by (Donkers and van Soest, 1999; Hartog et al., 2002). According to these, older and lower educated males have a higher propensity to make suboptimal choices. Von Gaudecker et al. (2011) found the same direction of effects for the error propensity and Bellemare et al. (2015) also found that males had a higher propensity to make mistakes (at the 10% level).

Table 2.3 also shows the variance and covariance of our preference parameters corresponding to the vector ξ^{η} of unobserved heterogeneity. We find substantial heterogeneity around the averages. The variances of the unobserved heterogeneity terms are significantly different from zero ($t-test$, $p < 0.001$). We also find that the variance of the unobserved terms is much greater[11]. Next, we calculated the correlation coefficients ρ_{η} between these preferences at the individual level. The correlation between the risk aversion coefficient and the time discount rate is significant but close to zero ($\rho_{\gamma,r} = -0.1409$).

The mean risk aversion parameter γ for the whole sample is 0.0609, the mean error parameter τ is 5.574306 and the mean discount rate r is 0.0736. This is not directly comparable to other studies since our statistical method and/or functional forms differ. Nevertheless, if we look at

[11] Variance of (γ,τ , r) from observed characteristics: (0.0002, 0.2079, 0.000002) against the variance from unobserved characteristics: (0.0107, 2.6750, 10.3408).

Von Gaudecker et al. (2011), using an expo-power utility function, we obtain slightly larger estimates for γ. For time preferences we obtain a lower estimate for the discounting rate than Andersen et al. (2008) who find it around 10% for the case of quasi-hyperbolic discounting. We experimented with pure hyperbolic and CRRA utility function but did not find evidence that these would be a better fit.

Table 2.3: Estimates of Risk and Time Preferences with Exponential Utility

	Parameter	Std. error	Parameter	Std. error
γ_{cons}	0.0492	0.0007	0.0574	0.0019
γ_{edu}	-0.0027	0.0005	-0.0035	0.0014
γ_{fem}	0.0199	0.0012	0.0274	0.0038
γ_{age}	0.0003	0.0000	0.0001	0.0001
τ_{cons}	1.0433	0.0110	0.4195	0.0326
τ_{edu}	-0.1112	0.0077	-0.1182	0.0232
τ_{fem}	-0.0874	0.0197	-0.1783	0.0652
τ_{age}	0.0051	0.0007	0.0111	0.0023
r_{cons}	-3.8642	0.0513	-6.8203	0.1824
r_{edu}	-0.1993	0.0338	-0.5267	0.0287
r_{fem}	-0.0517	0.0913	-0.0871	0.0645
r_{age}	-0.0022	0.0032	0.0029	0.0024
MaxLogL	30807.15577		25765.99	
n = 2825				
Unobserved heterogeneity	No		yes	
$V(\xi^{\gamma})$	0.0107	0.0003	$\rho(\gamma,\tau)$	-0.7473
$V(\xi^{\tau})$	2.6750	0.1013	$\rho(\gamma,r)$	-0.1409
$V(\xi^{r})$	10.3408	0.6446	$\rho(\tau,r)$	-0.0981
$Cov(\xi^{\gamma},\xi^{\tau})$	-0.1263	0.0048		
$Cov(\xi^{\gamma},\xi^{r})$	-0.0468	0.0033		
$Cov(\xi^{r},\xi^{\tau})$	-0.5162	0.0598		

Note: Estimation results of the structural econometric model with CARA utility and exponential discounting ($\beta = 1$)

Table 2.4 shows the predicted parameters γ, τ, r, the number of risky choices that participants took and whether they switched more than once during a treatment. These subjects were chosen randomly to illustrate how our predictions relate to the raw choice data. We can observe that someone who took more risky choices, e.g., subject S4 who chose the risky option in 16 out of 20 choices, has a negative coefficient of risk aversion (implying risk seeking behavior). This is opposed to what we observe for participant S2500, who only took 2 risky choices and therefore has a much higher predicted risk aversion coefficient. The higher the coefficient is, the more curved the respondent's utility function. The same relationship can be observed by looking at the discount rate and the number of impatient choices in the experiment.

Table 2.4: Example Subjects: 4, 5, 100, 2500

Participant	Experimental			Raw choices		
	γ	τ	r	Tot risky	Tot present	Switching
S4	-0.0880	22.8596	0.0113	16	15	yes
S5	0.0119	1.6838	0.0042	11	10	no
S100	0.1277	3.1998	0.0050	9	12	no
S2500	0.1928	2.2376	0.0035	2	7	yes

2.4 Results

Personality traits and economic preferences

The literature in psychology has found many ways in which we can classify different aspects of human behavior. We focused on the Big-5 because of the overall consensus of the existence of these five patterns and we can compare our results to previous findings. To incorporate these personality traits into our analysis of risk and time preferences, we make use of the *personality* questionnaire available in the LISS panel. This survey contains 50 questions which are designed to capture five personality traits (the Big-5) according to Goldberg et al. (2006). These personality traits are the following: Extraversion, Neuroticism, Agreeableness, Conscientiousness and Openness/Intellect. We converted the responses into a scale by adding scores assigned to each question per trait.[12]

Table 2.5 contains the correlations between our predicted preference parameters and the personality traits. We observe similar correlation patterns to those of Almulund et al. (2014) and Becker et al. (2012); risk aversion increases with Agreeableness and Conscientiousness and decreases with Intellect/Openness. (Almulund et al. (2014) found an insignificant correlation with Conscientiousness.) The impatience parameter is negatively correlated with Intellect/Openness. This is a consistent finding across studies. Stated preferences for risk aversion and impatience show higher correlations, all in the same direction. The correlation between Neuroticism and risk aversion or impatience measured in the experiment was insignificant, but we do find a significantly negative correlation between Neuroticism and stated risk seeking and a significantly positive correlation between Neuroticism and stated impatience.

[12]The exact conversion of responses to scores is explained in the International personality item pool (IPIP) website: http://ipip.ori.org/newScoringInstructions.htm

Table 2.5: Pearson's correlations between traits and preferences

	Risk aver	Discount	Error	Risk taking	Impatience
Extraversion	-0.023	-0.012	0.021	0.172	0.078
	(0.238)	(0.534)	(0.284)	(0.000)	(0.000)
Agreeableness	0.084	0.005	-0.067	-0.048	-0.022
	(0.000)	(0.793)	(0.001)	(0.016)	(0.268)
Conscientiousness	0.041	0.004	-0.001	-0.100	-0.267
	(0.037)	(0.843)	(0.968)	(0.000)	(0.000)
Neuroticism	0.027	0.023	0.024	-0.101	0.127
	(0.177)	(0.242)	(0.226)	(0.000)	(0.000)
Intellect/Openness	-0.033	-0.047	-0.085	0.070	-0.014
	(0.093)	(0.019)	(0.000)	(0.000)	(0.484)

Note: p-values in parentheses.

Recent research in psychology has shown that personality traits can change over time (Srivastava et al., 2003; Roberts and Mroczek, 2008), with the largest changes happening in young adulthood (20-40 years old). For example, Conscientiousness, which is associated with the ability to exert control over behavior and impulses, shows the largest change when individuals are in their twenties – at the start of their professional career. Agreeableness, which reflects the tendency towards altruism and cooperation, exhibits most changes during a person's thirties, which often coincides with the creation of a family. Neuroticism is the only trait of the five that is consistently higher for women. It may also be the case that education helps to shape some traits.

We therefore control for age (using brackets of ten years each), gender, and education when analyzing the relation between the economic parameters and personality traits. The first half of Table 2.6 shows OLS regressions explaining risk aversion, impatience and error propensity; in the second half, we show the same specifications explaining stated preferences instead. In addition to adding age controls, we also ran regressions interacting the first two age brackets (age$<$35), with personality traits. However, we do not find these interactions to be significant.

The results largely correspond to the Pearson correlation coefficients. Extraversion, Conscientiousness and Neuroticism are much stronger predictors of the stated measures of risk and time preferences than they are for the experimental measures, but for Agreeableness, we find the opposite. The relation between Intellect/Openness and risk and time preferences almost completely disappears when education level is kept constant.

In columns (3) and (6) we show the regressions for our individual prediction of error propensity; as expected, here we find a negative correlation with Intellect/Openness (even if education is kept constant). But we also find a negative association with Agreeableness and a positive association with Extraversion. “Agreeable" respondents make fewer errors, while “extravert" respondents make more errors than average.

Table 2.6: OLS regressions on Economic preferences

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Risk aversion	Impatience	Error prop	Risk aversion	Impatience	Error prop	Risk taking	Impatience	Risk taking	Impatience
Extraversion	-0.037*	0.023	0.063***	-0.026	0.037*	0.063***	0.175***	0.105***	0.162***	0.105***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)	(0.020)	(0.020)	(0.020)
Agreeableness	0.097***	-0.045**	-0.081***	0.049**	-0.077***	-0.070***	-0.079***	0.031	-0.019	0.026
	(0.022)	(0.022)	(0.021)	(0.023)	(0.022)	(0.022)	(0.021)	(0.020)	(0.022)	(0.021)
Consc.	0.024	0.012	0.005	0.008	-0.013	0.001	-0.104***	-0.254***	-0.086***	-0.258***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)	(0.021)	(0.021)	(0.020)	(0.021)	(0.020)
Neuroticism	0.018	0.044**	0.050**	-0.008	0.008	0.048**	-0.074***	0.109***	-0.046**	0.105***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.019)	(0.020)	(0.020)	(0.019)	(0.020)	(0.019)
Intellect	-0.051**	-0.109***	-0.081***	-0.009	-0.012	-0.056***	0.063***	0.009	0.021	0.024
	(0.021)	(0.021)	(0.021)	(0.022)	(0.021)	(0.022)	(0.021)	(0.020)	(0.021)	(0.021)
Age										
25-34	-0.126	-0.108	0.125	-0.056	0.044	0.159	0.046	-0.305**	-0.023	-0.289**
	(0.152)	(0.150)	(0.148)	(0.151)	(0.142)	(0.147)	(0.147)	(0.141)	(0.146)	(0.141)
35-44	-0.075	0.014	0.192	0.009	0.098	0.184	0.020	-0.310**	-0.076	-0.309**
	(0.147)	(0.145)	(0.143)	(0.146)	(0.138)	(0.143)	(0.143)	(0.137)	(0.141)	(0.137)
45-54	-0.038	0.071	0.296**	0.026	0.075	0.263*	0.053	-0.376***	-0.033	-0.386***
	(0.147)	(0.145)	(0.143)	(0.146)	(0.137)	(0.143)	(0.142)	(0.136)	(0.141)	(0.136)
55-64	-0.025	0.178	0.470***	0.030	0.145	0.428***	0.030	-0.581***	-0.058	-0.589***
	(0.146)	(0.144)	(0.142)	(0.145)	(0.137)	(0.142)	(0.141)	(0.135)	(0.140)	(0.136)
>65	-0.061	0.183	0.651***	-0.004	0.102	0.592***	-0.003	-0.683***	-0.110	-0.687***
	(0.146)	(0.144)	(0.142)	(0.146)	(0.137)	(0.143)	(0.141)	(0.135)	(0.141)	(0.136)
Female				0.261***	0.100**	-0.090**			-0.342***	0.022
				(0.044)	(0.041)	(0.043)			(0.042)	(0.041)
Education										
Intermed Voc Ed				-0.134***	-0.399***	-0.063			0.036	0.037
				(0.052)	(0.049)	(0.051)			(0.050)	(0.049)
Higher Voc Ed				-0.179***	-0.743***	-0.242***			0.102**	-0.014
				(0.053)	(0.049)	(0.051)			(0.051)	(0.049)
University				-0.215***	-0.932***	-0.324***			0.122*	-0.198***
				(0.075)	(0.071)	(0.074)			(0.073)	(0.071)
Constant	0.064	-0.097	-0.385***	-0.030	0.224	-0.204	-0.035	0.450***	0.180	0.456***
	(0.140)	(0.138)	(0.136)	(0.146)	(0.137)	(0.143)	(0.136)	(0.130)	(0.141)	(0.137)
Observations	2,541	2,541	2,541	2,541	2,541	2,541	2,541	2,541	2,541	2,541
R-squared	0.013	0.027	0.055	0.036	0.135	0.068	0.057	0.126	0.084	0.130

Notes: Columns (1)-(6) explain the experimental measures, columns (7)-(10) explain the stated preference measures. All preference and personality variables are standardized to have mean zero and variance one. Impatience and error propensity are represented in logarithms.

Portfolio choice and financial wealth

The LISS panel collects self-reported financial information of most of our participants. For this section, we selected three questions from the survey on assets to construct our two financial outcome variables. These questions are asked to every panel participant, but if the person answering the question has joint financial wealth or investments with her spouse, then only one of them answers the question– the household head[13]. The first question, the ownership of risky assets, is a binary question which asks each individual whether they have any type of investments:

> *Did you own one of the following assets in the previous year? Investments (growth funds, share funds, bonds, stocks, options, warrants).*
> *Yes / No*

We do not have more detailed information on the exact type of financial assets which they posses, therefore we treated everything as a "risky investment" even though the risk between these can be quite different. We defined the second variable as *financial wealth* and we constructed it by summing up the total value of their individual investments and the money they have in their bank statements at the moment. This variable is problematic since many individuals claim to have zero financial wealth.

Since these decisions are likely to be at the household level, we only consider the answers given by the self-reported *financial decision maker* of the family[14]. However, we are aware that because of how the question is constructed, some of the investments or savings declared by the household head could also be shared with their spouses [15]. As shown on Table 2.1, around 14% of people in our sample has risky investments; when we restrict attention to the answers at the household level, we find that around 18% of households have risky assets.

To model the relationship between investment decisions and our experimental variables we define a probit model of the latent propensity to invest in risky financial assets. In this model we defined as dependent variable the binary decision to invest in risky assets. As explanatory

[13] If the person who is not the household head has her own financial assets separately, she answers the question herself.

[14] We also performed our analysis on the household heads only, but this would leave us with a mostly male sample (13% of females are household heads). If we consider the financial decision maker of the family, we have a more gender balanced sample (56% male and 44%female)

[15] We explore this issue further in the next chapter.

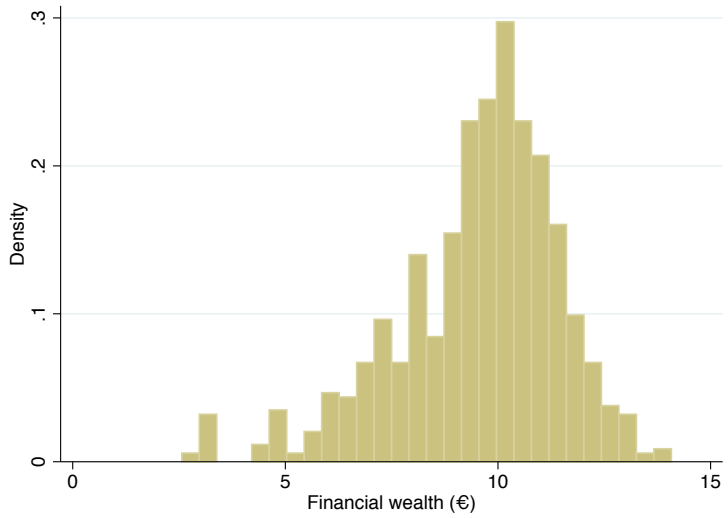


Figure 2.4: Financial wealth

variables in our model, we included a vector of characteristics such as age, gender, level of education (with lower education as base category) and monthly gross income of individuals. In all specifications, we controlled for family characteristics such as the number of children. To model the relationship with financial wealth we estimated a tobit model.

Table 2.7 is divided in three parts where we include the same controls. Columns (1) and (2) show the results of adding only economic preferences as explanatory variables of economic outcomes. The second part of the Table shows the results of including personality traits only (columns (3) and (4)). Finally, on the last section of Table 2.7, we show the results of including both economic preferences and personality traits (columns (5) and (6)).

We find that people who are more risk averse are less likely to own risky assets. Having a higher propensity to make suboptimal choices (error), is negatively correlated with all financial outcomes. Higher education, age and income result in a higher likelihood of investment and women are less likely to have risky investments. We find that the coefficient of the discount rate is negative but not significant, i.e., people who discount the future more heavily are less likely to have more money invested in risky assets. Column (2) shows the results of a tobit regression on financial wealth accumulation. Here, risk aversion and error propensity are negative and significant at the 1% level. The discounting parameter is significant at the 5% level. The sign shows that the more impatient people are, the less financial wealth they posses.

In the second section of Table 2.7, i.e., columns (3) and (4), we find a weak effect of Agree-

Table 2.7: Preferences, traits and financial outcomes of decision makers

	(1) Invest risky	(2) Fin wealth	(3) Invest risky	(4) Fin wealth	(5) Invest risky	(6) Fin wealth
Female	-0.213**	-0.170	-0.168	-0.262	-0.140	-0.217
	(0.106)	(0.150)	(0.108)	(0.162)	(0.111)	(0.162)
Age	0.053**	0.120***	0.049**	0.115***	0.054**	0.120***
	(0.022)	(0.027)	(0.022)	(0.027)	(0.022)	(0.027)
Age^2	-0.000*	-0.001***	-0.000	-0.001***	-0.000*	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Num kids	0.013	-0.012	0.026	-0.018	0.017	-0.023
	(0.048)	(0.069)	(0.048)	(0.069)	(0.048)	(0.068)
Education						
Intermed Voc Ed	-0.159	0.334*	-0.114	0.409**	-0.165	0.317*
	(0.132)	(0.171)	(0.130)	(0.169)	(0.133)	(0.170)
Higher Voc Ed	0.370***	0.812***	0.456***	0.989***	0.366***	0.842***
	(0.120)	(0.175)	(0.119)	(0.168)	(0.123)	(0.174)
University	0.645***	1.069***	0.743***	1.284***	0.644***	1.137***
	(0.149)	(0.207)	(0.148)	(0.207)	(0.152)	(0.209)
Log income	0.088**	0.060	0.094**	0.065	0.086**	0.068
	(0.038)	(0.047)	(0.039)	(0.047)	(0.038)	(0.047)
Risk aversion	-2.346***	-2.648***			-2.273***	-2.904***
	-0.693	-1.004			-0.686	-1.01
Error prop	-0.025***	-0.030**			-0.025***	-0.032***
	-0.009	-0.012			-0.009	-0.012
Impatience	-0.318	-0.844**			-0.329	-0.811**
	-0.3	-0.396			-0.309	-0.396
Extraversion			-0.036	0.012	-0.027	0.009
			(0.071)	(0.087)	(0.072)	(0.086)
Agreeableness			-0.241*	-0.022	-0.243*	-0.016
			(0.126)	(0.187)	(0.126)	(0.184)
Consc.			-0.031	0.354**	-0.024	0.368***
			(0.109)	(0.143)	(0.110)	(0.141)
Neuroticism			-0.220	-0.042	-0.167	0.011
			(0.146)	(0.191)	(0.145)	(0.192)
Intellect			-0.002	-0.291	-0.035	-0.349*
			(0.150)	(0.189)	(0.150)	(0.188)
Constant	-3.113***	4.928***	-1.581	4.675***	-1.480	4.819***
	(0.644)	(0.735)	(0.992)	(1.303)	(0.997)	(1.292)
Observations	1,182	784	1,182	784	1,182	784
ll	-513.2	-1525	-516.2	-1527	-509.9	-1521

Notes: Probit regressions on propensity to own risky investments on columns 1, 3 and 5. Tobit regressions on amount of financial wealth on columns 2, 4 and 6. Clustered standard errors at the household level $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Table 2.8: Stated preferences, personality traits and financial outcomes

	(1) Invest risky	(2) Fin wealth	(3) Invest risky	(4) Fin wealth	(5) Invest risky	(6) Fin wealth
Female	-0.126	-0.179	-0.169	-0.260	-0.044	-0.206
	(0.106)	(0.146)	(0.108)	(0.162)	(0.112)	(0.159)
Age	0.053**	0.113***	0.051**	0.112***	0.056***	0.115***
	(0.021)	(0.024)	(0.022)	(0.025)	(0.022)	(0.024)
Age^2	-0.000**	-0.001***	-0.000*	-0.001***	-0.000**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Education						
Intermed Voc Ed	-0.110	0.451***	-0.113	0.408**	-0.110	0.448***
	(0.133)	(0.168)	(0.130)	(0.170)	(0.134)	(0.168)
Higher Voc Ed	0.428***	0.929***	0.457***	0.987***	0.428***	0.959***
	(0.118)	(0.162)	(0.119)	(0.167)	(0.120)	(0.162)
University	0.692***	1.149***	0.744***	1.284***	0.689***	1.209***
	(0.147)	(0.198)	(0.148)	(0.207)	(0.150)	(0.203)
loginc	0.108***	0.062	0.095**	0.065	0.109***	0.062
	(0.039)	(0.045)	(0.039)	(0.047)	(0.039)	(0.046)
Risk taking	0.112***	0.039			0.117***	0.040
	(0.021)	(0.028)			(0.022)	(0.030)
Impatience	-0.065***	-0.186***			-0.068***	-0.184***
	(0.021)	(0.026)			(0.021)	(0.027)
Extraversion			-0.036	0.011	-0.090	0.061
			(0.071)	(0.087)	(0.077)	(0.087)
Agreeableness			-0.239*	-0.024	-0.219*	-0.044
			(0.126)	(0.187)	(0.129)	(0.176)
Consc.			-0.030	0.353**	-0.096	0.115
			(0.109)	(0.143)	(0.114)	(0.138)
Neuroticism			-0.221	-0.041	-0.123	0.120
			(0.146)	(0.191)	(0.152)	(0.191)
Intellect			-0.007	-0.287	-0.011	-0.258
			(0.150)	(0.188)	(0.153)	(0.187)
Constant	-3.675***	5.397***	-1.600	4.693***	-1.966**	5.429***
	(0.647)	(0.716)	(0.988)	(1.293)	(0.989)	(1.262)
Observations	1,182	784	1,182	784	1,182	784
ll	-503.6	-1505	-516.4	-1527	-499.4	-1504

Notes: Probit regressions on propensity to own risky investments on columns 1, 3 and 5. Tobit regressions on amount of financial wealth on columns 2, 4 and 6. Clustered standard errors at the household level $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

ableness on investments and a strong effect of Conscientiousness on the amount of financial wealth. Intellect is weakly correlated to having more financial wealth.

Once we included all preferences and traits, we find that the coefficients on economic preferences and personality traits change only slightly and do not lose significance except for Intellect. As mentioned before, the latter trait is correlated with all economic preferences.

We repeated the analysis on portfolio choice including stated preferences in our regressions of portfolio decisions. In the previous subsection, we showed that risk taking is correlated with all Big-5. Table 2.8 shows the results for the same regressions as in previous sections but with stated preferences. The patterns which arise are very similar to the previous analysis using experimental measures. The main difference is that none of the traits are significant in predicting the investment choice when we include economic preferences in the equation. We find the same results for Conscientiousness, i.e., it is positively correlated to financial wealth accumulation, keeping economic preferences constant. Intellect does not correlate to financial wealth, which is opposed to results on Table 2.7 where we controlled for the error parameter which is also correlated to Intellect.

As part of a sensitivity check, we considered also households with negative or zero financial wealth and we find a difference in the size of the effects but the relationships (in terms of sign and significance) remain the same[16].

In all specifications we found that the propensity to make suboptimal choices is significant in explaining the likelihood of investment and the amount of financial wealth. People that make less mistakes in our experiment are people who are better skilled in mathematical calculations and in financial literacy. Available in the LISS panel is a measure of probability numeracy used by Dillingh et al. (2015) and financial literacy similar to the one used in Van Rooij et al. (2011). We found a correlation of -0.22 between our error prediction and the numeracy index. The correlation with financial literacy is -0.16. Obtaining individual level predictions of the tendency to make errors can be useful for researchers who do not have measures of numeracy, intelligence or financial literacy but would like to control for it in their estimations.

2.5 Summary and conclusion

In this paper we analyzed risk and time preferences of a representative sample of the Dutch population. To measure individual attitudes we proposed a joint lottery task which could identify both preference parameters and we also modelled the propensity to choose suboptimal options. The experiment was carried out in the LISS panel, an internet survey. We also elicited alternative risk taking and impatience measures qualitatively by means of survey questions. We constructed Big-5 personality scores for each of our participants for which we had informa-

[16] See Tables 2.11 and 2.12.

tion from the panel. The goal of this paper was to study the relationship between economic preferences and personality.

From our structural model of preferences, we found that women are more risk averse and discount the future more. This is in line with what other studies have found (Falk et al., 2015; Dohmen et al., 2010). Higher educated and higher income individuals in turn, are less risk averse and discount the future less. We find a high degree of heterogeneity in the population, specially with respect to time preferences. With respect to age patterns, from the experiment we do not find significant coefficients of age in predicting risk or time preferences. However, if we look at the stated measures, we observe a negative correlation between age and impatience. Using information on their personal finances we studied whether our measures correlate with investments and financial wealth accumulation. We found that risk aversion is negatively correlated with the probability of owning investments, and the amount invested in them. The discounting factor is significant in predicting the amount of money that an individual has accumulated as financial wealth. The negative coefficient implies that people who value consumption in the future less, have on average also less financial wealth.

A lot of attention has been given in recent years to the relationship between economic preferences and personality traits. Therefore, to explore the relationship between our preference measures and financial outcomes, we incorporated psychological measures of personality into our analysis of portfolio choice. We found that some personality traits as measured by the Big-5 are strongly correlated to economic preferences. The discounting parameters are mostly correlated to the Intellect/Openness trait and Agreeableness when we measure discounting experimentally. After controlling for education, the propensity to make suboptimal choices remains significantly correlated to personality traits.

Once we established the relationship between traits and preferences, we tested whether the channel through which personality has an effect on financial choices is through economic preference formation. We find that personality traits cannot explain the likelihood to have risky assets except for a weak effect from Agreeableness. We found Conscientiousness to be strongly correlated to financial wealth but not to the individual predictions of economic preferences. This is in line with a recent study of truck drivers by Rustichini et al. (2016), who failed to find a connection between experimental measures of preferences and Conscientiousness. This shows that this trait has a direct effect on real life outcomes. We complement the literature on the predictive power of this personality traits in a wide range of life outcomes. Conscientiousness has been found to be the most predictive of the Big Five across outcomes such as education

outcomes (Almulund et al., 2014). According to their study, this psychological trait has been shown to predict college grades better than SAT records. Job market outcomes such as job performance are also best predicted by Conscientiousness of the Big Five, however it is less predictive than measures of intelligence. This trait also predicts health outcomes, e.g., longevity, better than intelligence or background.

In summary, we do not find evidence that the mechanism through which personality traits have an effect on real life decisions is through the formation of economic preferences. We showed this in two steps, by regressing economic outcomes on preferences and traits alone, and then adding them both to the analysis. Our results point towards complementarity of economic preferences and personality traits in explaining economic outcomes.

Future research on preference formation could be directed at studying younger individuals or children at stages in which both preferences and personality presents the strongest changes. It would be useful to identify which factors have a strong effect in shaping both preferences and personality. For example, Deckers et al. (2015) show that socioeconomic status is a strong predictor of several facets of a child's personality. Other psychological traits and other measures could be of interest to modeling economic decisions, e.g., scales such as the Barrett Impatience Scale in psychology for which some of the questions are in the LISS panel.

Appendix

Questionnaire for LISS panel

Instructions

The following questionnaire consists of 4 sections in which you are asked for your preference between two sets of lotteries. The goal of this research is to study how people make choices when they face some degree of risk and if payments are made at different points in time. You can earn money in this exercise! Each section has different amounts that you can earn based on different lotteries. Your final earnings will be based on your choices and some chance. There is no right or wrong answer, the only thing that we are interested in is your personal preference. Be sure to always choose the option that you really prefer because at the end of the questionnaire one of the sections will be selected and one of the questions will be played out for payment with 1/10 chance.

Part 1-Lottery choices

In the following screen you are asked to make a choice between A and B for each question. You have to tick the box for either A or B according to your most preferred choice. Please note that payments are either made as soon as possible (with your first LISS payment) or three or six months later, as indicated at the top of the screen. Once you are finished you can continue to the next screen.

Part 2- Qualitative questions

Risk aversion questions

1. How do you see yourself? Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please give a value between 0 and 10, with 0 for "not at all willing to take risks" and 10 for "very willing to take risks.
2. How would you rate your willingness to take risks concerning financial matters?
3. your willingness to take risks... - in your occupation?

4. your willingness to take risks... - during leisure and sport?

To each question above, the following was also added in the same screen:

1. How do you see your partner? Is she generally a person who is fully prepared to take risks or does she try to avoid taking risks?
2. How would you rate her willingness to take risks concerning financial matters?
3. her willingness to take risks... - in her occupation?
4. her willingness to take risks... - during leisure and sport?

Time preference questions:

1. How much do you agree with the following: If I get money I tend to spend it too quickly (on a scale from 0 strongly disagree to 10 fully agree).
2. What do you think your spouse would respond to the previous question?
3. On a scale from 0 to 10, how patient do you consider yourself to be? (10 being the most patient value)
4. On a scale from 0 to 10, how patient do you consider your spouse to be? (10 being the most patient value)

At the end of the survey the following questions are added as standard procedure of the LISS panel:
Finally; what did you think of this questionnaire?
1 = certainly not
5 = certainly yes
Was it difficult to answer the questions?

Were the questions sufficiently clear?

Did the questionnaire get you thinking about things?

Was it an interesting subject?

Did you enjoy answering the questions?

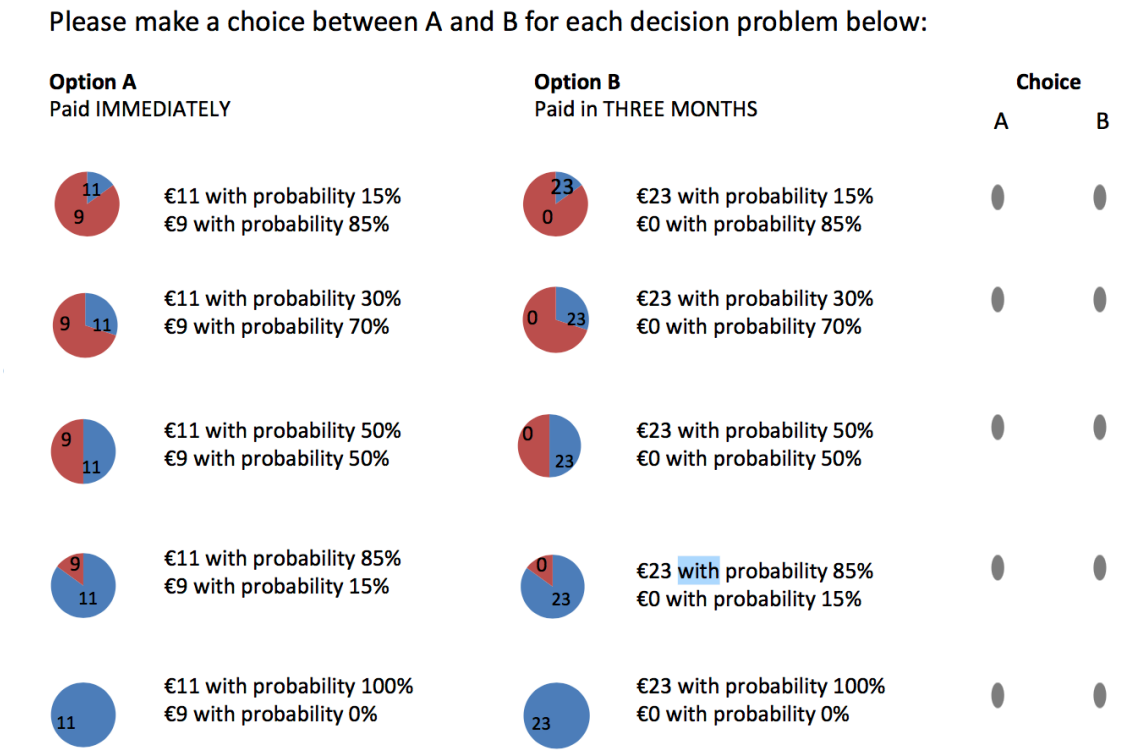


Figure 2.5: Screen example

Table 2.9: Details of the experimental design

Treatment	$p_{\mathbf{A}}$	$\$_{\mathbf{Ah}}$	$p_{\mathbf{A}}$	$\$_{\mathbf{Al}}$	**EVA**	$p_{\mathbf{B}}$	$\$_{\mathbf{Bh}}$	$p_{\mathbf{B}}$	$\$_{\mathbf{Bl}}$	**EVB**	**EVA-EVB**
Timing		6 months					3 months				
I	0.15	11	0.85	9	9.3	0.15	23	0.85	0	3.45	5.85
	0.3	11	0.7	9	9.6	0.3	23	0.7	0	6.9	2.7
	0.5	11	0.5	9	10	0.5	23	0.5	0	11.5	-1.5
	0.85	11	0.15	9	10.7	0.85	23	0.15	0	19.55	-8.85
	1	11	0	9	11	1	23	0	0	23	-12
Timing		9 months					6 months				
II	0.15	15	0.85	10	10.75	0.15	29	0.85	4	7.75	3
	0.3	15	0.7	10	11.5	0.3	29	0.7	4	11.5	0
	0.5	15	0.5	10	12.5	0.5	29	0.5	4	16.5	-4
	0.85	15	0.15	10	14.25	0.85	29	0.15	4	25.25	-11
	1	15	0	10	15	1	29	0	4	29	-14
Timing		3 months					0 months				
III	0.15	20	0.85	15	15.75	0.15	25	0.85	2	5.45	10.3
	0.3	20	0.7	15	16.5	0.3	25	0.7	2	8.9	7.6
	0.5	20	0.5	15	17.5	0.5	25	0.5	2	13.5	4
	0.85	20	0.15	15	19.25	0.85	25	0.15	2	21.55	-2.3
	1	20	0	15	20	1	25	0	2	25	-5
Timing		3 months					6 months				
IV	0.15	12	0.85	7	7.75	0.15	22	0.85	0	3.3	4.45
	0.3	12	0.7	7	8.5	0.3	22	0.7	0	6.6	1.9
	0.5	12	0.5	7	9.5	0.5	22	0.5	0	11	-1.5
	0.85	12	0.15	7	11.25	0.85	22	0.15	0	18.7	-7.45
	1	12	0	7	12	1	22	0	0	22	-10

Notes: Each treatment consisted of five possible choices. $P_{A,B}$ are the probabilities of choice A, B with high and low payoff. EVA: Expected value of option A; EVB: Expected value of option B. The last column shows the difference between EVA and EVB. Each treatment varied in the timing of the payoffs from 0 to 9 months.

Table 2.10: Dominated options and demographics

	Mean dom	std.	Mean rest	std	Difference
Female	0.57	0.50	0.50	0.50	Pr(T > t) = 0.0495
Position	1.65	0.62	1.59	0.67	Pr(T > t) = 0.1540
Age	58.26	12.87	52.01	14.91	Pr(T > t) = 0.0000
Civil status	1.40	1.13	1.70	1.47	Pr(T < t) = 0.0092
Income	1737.80	1394.92	2195.76	1913.89	Pr(T < t) = 0.0045
Family income	4101.86	1859.92	4594.95	2876.05	Pr(T < t) = 0.0326
Education cat	3.02	1.49	3.68	1.46	Pr(T < t) = 0.0000
Num kids	0.56	0.87	0.83	1.11	Pr(T < t) = 0.0024
Risk stated	2.95	2.41	3.25	2.31	Pr(T < t) = 0.0765
Money pat	6.34	2.32	6.45	2.02	Pr(T < t) = 0.5358
Obs	133		2874		

Notes: the last column presents the p-values of a two sample t-test. Income is stated as the gross income per month in euros. *Mean dom* shows the means for the subsample of people who choose always dominated options. *Mean rest* shows the means for the rest of the sample.

Table 2.11: Preferences, traits and financial outcomes of decision makers

	(1) Invest risky	(2) Fin wealth	(3) Invest risky	(4) Fin wealth	(5) Invest risky	(6) Fin wealth
Female	-0.213**	-2.119***	-0.168	-2.357***	-0.140	-2.120***
	(0.106)	(0.461)	(0.108)	(0.481)	(0.111)	(0.475)
Age	0.053**	-0.037	0.049**	-0.079	0.054**	-0.053
	(0.022)	(0.090)	(0.022)	(0.094)	(0.022)	(0.091)
Age^2	-0.000*	0.001	-0.000	0.001	-0.000*	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Num kids	0.013	0.011	0.026	0.061	0.017	0.028
	(0.048)	(0.207)	(0.048)	(0.212)	(0.048)	(0.206)
Education						
Intermed Voc Ed	-0.159	-0.217	-0.114	0.188	-0.165	-0.242
	(0.132)	(0.554)	(0.130)	(0.558)	(0.133)	(0.552)
Higher Voc Ed	0.370***	1.401***	0.456***	2.235***	0.366***	1.401***
	(0.120)	(0.524)	(0.119)	(0.520)	(0.123)	(0.527)
University	0.645***	2.137***	0.743***	3.046***	0.644***	2.084***
	(0.149)	(0.643)	(0.148)	(0.646)	(0.152)	(0.655)
Log income	0.088**	0.180	0.094**	0.232*	0.086**	0.202
	(0.038)	(0.126)	(0.039)	(0.129)	(0.038)	(0.124)
Risk aversion	-2.346***	-14.118***			-2.273***	-13.955***
	(0.693)	(3.032)			(0.686)	(3.051)
Error prop	-0.025***	-0.212***			-0.025***	-0.207***
	(0.009)	(0.039)			(0.009)	(0.039)
Impatience	-0.318	-3.993***			-0.329	-3.893***
	(0.300)	(1.282)			(0.309)	(1.267)
Extraversion			-0.036	-0.584*	-0.027	-0.466
			(0.071)	(0.309)	(0.072)	(0.305)
Agreeableness			-0.241*	0.035	-0.243*	-0.070
			(0.126)	(0.538)	(0.126)	(0.521)
Consc.			-0.031	1.006**	-0.024	1.016**
			(0.109)	(0.467)	(0.110)	(0.460)
Neuroticism			-0.220	-0.382	-0.167	-0.108
			(0.146)	(0.647)	(0.145)	(0.641)
Intellect			-0.002	0.894	-0.035	0.648
			(0.150)	(0.653)	(0.150)	(0.645)
Constant	-3.113***	4.784**	-1.581	-0.402	-1.480	1.118
	(0.644)	(2.375)	(0.992)	(4.210)	(0.997)	(4.094)
Observations	1,182	1,180	1,182	1,180	1,182	1,180
ll	-513.2	-2921	-516.2	-2940	-509.9	-2917

Notes: Probit regressions on propensity to own risky investments on columns 1, 3 and 5. Tobit regressions on amount of financial wealth on columns 2, 4 and 6. Clustered standard errors at the household level $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Complete sample including observations where wealth = 0.

Table 2.12: Preferences, traits and financial outcomes

	(1) Invest risky	(2) Fin wealth	(3) Invest risky	(4) Fin wealth	(5) Invest risky	(6) Fin wealth
Female	-0.126	-2.373***	-0.169	-2.361***	-0.044	-2.321***
	(0.106)	(0.475)	(0.108)	(0.481)	(0.112)	(0.489)
Age	0.053**	-0.056	0.051**	-0.073	0.056***	-0.069
	(0.021)	(0.089)	(0.022)	(0.089)	(0.022)	(0.089)
Age^2	-0.000**	0.001	-0.000*	0.001	-0.000**	0.001
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)
Education						
Intermed Voc Ed	-0.110	0.241	-0.113	0.197	-0.110	0.211
	(0.133)	(0.559)	(0.130)	(0.557)	(0.134)	(0.557)
Higher Voc Ed	0.428***	2.274***	0.457***	2.240***	0.428***	2.209***
	(0.118)	(0.509)	(0.119)	(0.520)	(0.120)	(0.516)
University	0.692***	3.076***	0.744***	3.050***	0.689***	2.938***
	(0.147)	(0.629)	(0.148)	(0.646)	(0.150)	(0.645)
loginc	0.108***	0.221*	0.095**	0.232*	0.109***	0.239*
	(0.039)	(0.132)	(0.039)	(0.129)	(0.039)	(0.130)
Risk taking	0.112***	-0.006			0.117***	0.008
	(0.021)	(0.094)			(0.022)	(0.095)
Impatience	-0.065***	-0.255***			-0.068***	-0.210**
	(0.021)	(0.086)			(0.021)	(0.089)
Extraversion			-0.036	-0.582*	-0.090	-0.505
			(0.071)	(0.309)	(0.077)	(0.314)
Agreeableness			-0.239*	0.043	-0.219*	0.032
			(0.126)	(0.539)	(0.129)	(0.535)
Consc.			-0.030	1.008**	-0.096	0.703
			(0.109)	(0.467)	(0.114)	(0.489)
Neuroticism			-0.221	-0.385	-0.123	-0.257
			(0.146)	(0.647)	(0.152)	(0.655)
Intellect			-0.007	0.878	-0.011	0.933
			(0.150)	(0.655)	(0.153)	(0.655)
Constant	-3.675***	4.128*	-1.600	-0.451	-1.966**	0.584
	(0.647)	(2.496)	(0.988)	(4.194)	(0.989)	(4.277)
Observations	1,182	1,180	1,182	1,180	1,182	1,180
ll	-503.6	-2940	-516.4	-2940	-499.4	-2937

Notes: Probit regressions on propensity to own risky investments on columns 1, 3 and 5. Tobit regressions on amount of financial wealth on columns 2, 4 and 6. Clustered standard errors at the household level $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Complete sample including observations where wealth = 0.

3 | Risk and Time Preferences and Financial Decisions of Couples

3.1 Introduction

Many important economic decisions taken at the household level involve a certain degree of risk. Examples are decisions regarding consumption of durable goods, savings and the composition of household wealth, insurance, retirement plans, or health care. Many of these decisions are observed at the household level and result from joint decisions of the adults in the household. The existing literature shows that financial decisions are significantly affected by how decision-making power is allocated at home (De Palma et al., 2009). Members of the household might have different preferences regarding choices that involve risk and time dimensions. As an example, Browning (1995) states that women might be more inclined to save for old age since their life expectancy exceeds that of their husbands. If the age difference in the couple is large, this effect will be even stronger. Studying how different preferences of individuals in couples affect household decisions (e.g. portfolio choice behavior or wealth accumulation) is therefore of core economic interest.

Until recently, theoretical and empirical studies focused on the unitary model: expected utility-maximizing households with pooled resources, assuming a single set of preferences per household conforming to the axioms of expected utility theory (EUT). This model, however, has been observed to be inadequate in explaining household decisions when there is more than one person in the household. The assumptions of the unitary model were challenged by the work of Chiappori (1988), who modeled utility maximization as a weighted average of the utility of its members. This led to so-called collective bargaining models, where couples are assumed to make Pareto efficient decisions that result from some intra-household bargaining process (see,

e.g. Cherchye et al., 2012).

We contribute to the literature by modeling the relationship between couples' risk and time preferences and how these manifest when making portfolio choices in real life. Previous studies have found a positive correlation between spouses' risk and time attitudes, which would suggest positive assortative matching of spouses with regards to preferences (Dohmen et al., 2012), or no significant correlation (Abdellaoui et al., 2013). We find that the magnitude of this correlation depends on the method of elicitation. We also analyze the household decisions on financial wealth and whether or not this is invested in risky assets such as stocks or stock mutual funds.

We carried out an experiment to elicit individual risk and time preferences in the LISS panel.[1] The LISS Panel is an ongoing Internet panel covering the adult Dutch population, including those without internet. We focused on households of at least two adults living together (whether married or unmarried) as a couple. We find a small significant positive correlation between spouses' risk preferences, and an insignificant correlation between their discounting parameters. The risk aversion correlations appear to be stronger if a couple has been living together longer. We find that the husband's risk aversion coefficient is more influential in the household decision to invest in risky assets than the wife's. Both time preference parameters are significant in predicting the level of financial wealth a household has accumulated.

In section 3.2 we briefly discuss the relevant literature helping us motivate our study. In section 3.3 we present a summary of the experimental design and how we used the experimental data to estimate individual time and risk preference parameters. We also present descriptive statistics of the estimated risk and time preference parameters and of the background variables obtained from the core studies of the LISS panel. Section 3.5 contains the empirical results and section 3.6 presents the conclusions.

3.2 Related literature

This study is related to the stream of literature on household decision making and individual risk and time preferences. In order to understand the relevance that individual preferences have for decisions taken at the family level, we give an overview of the literature on these two topics. First, we mention the relevant literature on risk aversion and time preferences, specifically those

[1] See https://www.lissdata.nl/lissdata/.

studies that focus on the elicitation methods and recent applications to household decision making under uncertainty. Second, we describe the collective models of household decision making and some of their recent applications which motivate our analysis of portfolio decision making and bargaining over risky choices.

3.2.1 Risk attitudes and time preference

An important contribution to the experimental literature on risk aversion is an experiment performed in the field by Binswanger (1980). He designed and implemented a Multiple Price List methodology to elicit risk preferences of a group of households in rural India. Later this method became increasingly popular as a result of the seminal paper by Holt and Laury (2002). The main task consists of subjects making a series of choices involving a safe and a risky option. When subjects proceed through the task, the probability of the high outcome increases until it becomes one. In some experiments, subjects are allowed to switch more than once, giving rise to inconsistencies. Other experiments limit the actions of the individuals and only allow for one switch. The literature on risk aversion elicitation is very extensive and therefore, we refer readers to a survey by Charness et al. (2013) which summarizes most of the methods for eliciting risk aversion and their findings. As will be explained in detail in section 3.3, we made use of modified multiple price list (MPL) lotteries to elicit preferences (risk and time preferences jointly).

A popular method to elicit time preferences also uses a type of multiple price list, where instead of binary risky choices, subjects have to choose between receiving an immediate payoff or a delayed greater payoff in the future. Andersen et al. (2008) fielded both multiple price lists in a Danish sample in order to construct a structural model of choice under present and future uncertainty. Tanaka et al. (2010) gave similar tasks to subjects in rural Vietnam in order to fit prospect theory parameters and study their relation to background characteristics such as wealth.

There are many studies that look at experimentally elicited preferences and investigate how they differ when elicited in a group as opposed to individually. Charness and Sutter (2012) show that groups make decisions which are in line with predictions of game theory, i.e., exhibit less behavioral biases than individuals. However, the group on which we focus our study is a couple which may have different characteristics than groups consisting of strangers. For example, couples might be more inclined to share information or share resources in the household. Bateman

and Munro (2005) found that joint choices of couples typically are more risk averse than choices made by individuals. They also observed that couples had the same departures from expected utility theory as individuals do (e.g. the common ratio and common consequence effects). De Palma et al. (2009) studied how preferences of spouses can be aggregated and concluded that the decision making process is dynamic: men initially have more decision making power than women but this effect is reversed gradually as time passes by during the experiment. Abdellaoui et al. (2013) examined risk and time preferences of couples, inferred by eliciting certainty equivalents and present values. Decisions were studied separately and jointly. For decisions under risk, probabilistic risk attitudes of individuals and couples showed similar judgment biases and were compatible with an S-shaped probability weighting function. Couple's probabilistic risk attitudes were found to be a mix of the partners' attitudes (within the boundaries of each partner's individual attitude). They found that correlations between risk attitudes within couples are rather weak, not supporting the notion of assortative matching within the couple.

The studies mentioned so far gather revealed preferences with sample sizes limited to approximately 70 couples and data that do not give access to information on the households' finances or family background. In our current study, we recruited 1,188 couples for which we have background characteristics like age and education. A large fraction of this sample also includes financial controls.[2].

Another type of elicitation procedure is based on qualitative survey questions. An example is the research by Dohmen et al. (2012) who investigate the process of transmission of risk and trust attitudes across generations. Our survey has very similar questions (making our results comparable with the existing literature), described in detail in the next section. Dohmen et al. find a strong positive correlation between responses of spouses' attitudes towards risk taking, supporting the notion of assortative mating. This contrasts the findings of Abdellaoui et al. (2013). Also using qualitative survey questions, research by Bacon et al. (2014), shows that correlation among spouses can be due to a component of assortative matching and a socialization component. They looked at correlations of the individual effects of the two partners and they allowed for shocks to be correlated among spouses.

[2]Since we use self-reported data from the LISS panel, there tends to be some degree of noise and missing information.

3.2.2 Household decision making

In the past decades economists have started looking at households not as single decision making units but as an interaction of its members, each with their own preferences. This is what the collective models of intra-household bargaining propose (going against what was typically assumed, that households can be modeled as if they were single agents). Vermeulen (2002) lays out the main ideas behind these types of models in a survey. To understand the importance of the contribution of each member to financial decisions that concern the welfare of the household, we take account of individual preferences and indexes of the bargaining of each partner.

So far, the literature on collective models of household decision making has mainly focused on consumption and labor supply decisions. There are few studies which consider couples' decisions involving a certain degree of financial risk, such as decisions to invest in stocks, bonds or other risky assets. Attanasio and Lechene (2002) used data from the Mexican Progresa conditional cash transfer program to investigate intra-household decision making. Their results indicate that a shift of resources towards women tends to increase the weight that women have in the decision process: in households where women received a Progresa grant, women more often claim that they take important expenditure decisions. Jianakoplos and Bernasek (2008) investigated whether the relative bargaining power of spouses plays a role in explaining household financial risk taking. Their results support pooled-resource models, rather than bargaining models of household financial decision making. They found that household wealth allocated to risky assets and stated financial risk-taking preferences do not vary significantly with the relative bargaining power of spouses. Euwals et al. (2004) investigated whether husband and wife have different preferences for saving for old age, and how these preferences mattered for determining savings and portfolio behavior. They found that spouses' attitudes increase with their contribution to the income of the household.

One of our goals is to identify the possible existence of bargaining regarding financial decisions of the household and link this to the bargaining power of husbands and wives. We estimate reduced form models of household investments and savings to draw conclusions on the role of intra-household bargaining and how risk and time preferences of both partners drive household level decisions. In this sense our study is similar in methodology to that of Euwals et al.; the individual (risk and time) preferences we consider, however, are very different. They investigate the importance of attitudes of spouses towards household savings for old age with respect to household wealth and portfolio choice. They do so by constructing a reduced form

model with the attitudes for saving for old age weighed by their relative incomes. The main difference between their work and ours is that instead of accounting for attitudes for saving for old age (they use a survey question with a 7-point scale), we use different measures which relate to patience and risk taking (based on lottery experiments). We construct a similar reduced model of investments and financial wealth, which depend on both spouses' measures of preferences and other observed characteristics.

3.3 The Experiment and Individual Parameters

In order to elicit risk and time preferences we used a modified Multiple Price List experiment, consisting of four treatments in the gains domain with five choices in each treatment. In each treatment, each individual was asked five times to choose between two lotteries. Within each treatment, the lotteries in the five choices varied in the probabilities of low and high payoff, but not in the payoff levels or the timing of the payoff.

To identify risk aversion and time preference, payoffs and timing of payment did vary across the four treatments. Details can be found in the Appendix; in particular, Table 4.7. The timing of the payoffs varied between *immediately*, 3, 6 or 9 months. The idea was to capture risk and time preferences with a single task. Since risk and time preferences have been previously found to be correlated and since we aim to use these measures to explain real life choices, we decided to construct a new way of eliciting both jointly. This has the advantage of both minimizing the participants' mental burden and reducing the time of the elicitation procedure, limiting the burden on the respondents and the costs of the experiment.

At the end of the experiment the computer randomly picked one of the individual's choices, and individuals all had a 10% probability to be selected for payment. The complete payoff procedure was explained in the instructions. The experiment was incentivized with real money (euros) which were transferred to the participant's bank account at the time corresponding to the choice they made in the decision problem selected for real payment (e.g., almost immediately after the experiment was administered ("direct payment"), or approximately three months later ("Payment in three months"). The average payoff (without the participation fee) was 14 euros with a standard deviation of 7 euros and the median duration of the experiment was 9.35 minutes.

We tried to simplify the tasks as much as possible since they would be answered by a

representative sample of the Dutch population. Following Von Gaudecker et al. (2011), we included pie charts to help participants understand probabilities. We also used different colors to indicate the different time periods of payment. An example of a choice in our experiment is depicted in Figure 3.1. The order of the screens was randomized. We also allowed participants to jump to past screens if they desired to do so and we did not enforce a single switching point per screen. Enforcing one switch point could reduce the noise in our data, but since we were actually also interested in capturing the heterogeneity in quality of the responses, we would have lost valuable information regarding mistakes or inconsistencies which are common in the literature (see, e.g., Moffatt, 2016). In fact, in addition to individual specific parameters for risk aversion and time preference, our design also allows us to identify a third individual specific parameter - the individual's error propensity, an index for the tendency to make suboptimal or inconsistent decisions.

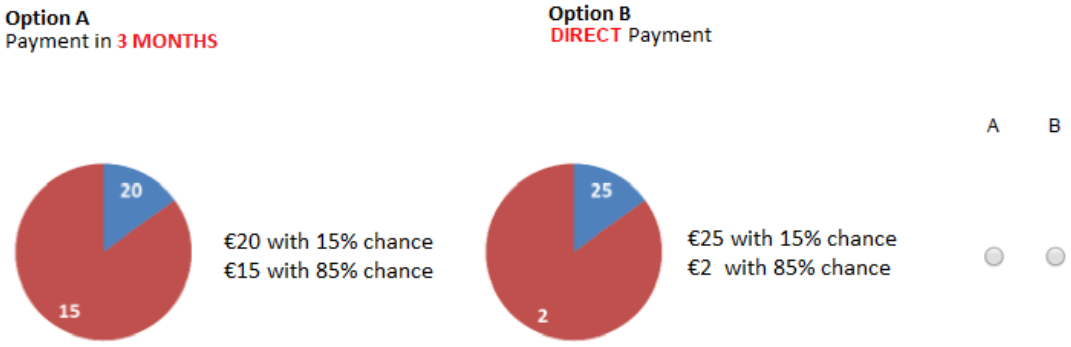


Figure 3.1: Choice example

A Random Coefficients Model

To obtain a prediction of individual specific parameters of risk aversion, time preference, and error propensity, we used the experimental data to estimate a structural model, following the empirical strategy similar to that of Von Gaudecker et al. (2011). Our aim was to estimate a parametrization of the utility function which would capture behavior and therefore included parameters of utility curvature, risk aversion, and time preference parameters from an exponential discount function. We allowed for heterogeneity in the tendency to make suboptimal decisions by including Fechner errors with a variance that varies across participants. The specification we used is as follows:

CARA Utility function:

$$U(\gamma, z) = \frac{1}{\gamma}(1 - e^{-\gamma z}) \tag{3.1}$$

where $\gamma \in \mathbb{R}$ is the coefficient of absolute risk aversion. The monetary payoff of a lottery is denoted by $z \in \mathbb{R}$.

Discounting factor:

$$D(r,t) = e^{-rt} \tag{3.2}$$

where r is the discount rate and t indicates the time delay being discounted. Note that when $t = 0$ this term is equal to 1. We also estimated different utility and discounting specifications, namely CRRA utility (power utility) and quasi-hyperbolic and pure hyperbolic discounting. The exponential and quasi-hyperbolic specifications fit the data better than the pure hyperbolic function. Initial estimation results showed that the estimated present bias parameter β was not significantly different from one. Therefore, we focus on the model with exponential discounting.

Discounted expected utility function:

$$DEU = D(r,t) * U(\gamma) \tag{3.3}$$

In addition to people choosing the lottery which maximizes their discounted expected utility (DEU), we introduce Fechner errors to model the choices. Therefore a subject will choose lottery B if:

$$DEU^B + \tau\varepsilon_B > DEU^A + \tau\varepsilon_A \tag{3.4}$$

The ε's follow a type I extreme value distribution and are independent of each other and the difference of the errors $\varepsilon = \varepsilon_A - \varepsilon_B$ follow a logistic distribution. The parameter τ can be interpreted as determining the size of the probability of making a mistake when choosing between A and B.

The individual specific parameters (risk aversion, discounting, and error propensity) are specified using a random coefficients model with vector of parameters $\eta_i = (\gamma_i, ln(r_i), ln(\tau_i))'$ and with $\eta_i = X_i\Pi + \widetilde{\eta}_i$. For each respondent i with given observed characteristics X_i, we assume $\widetilde{\eta}_i \sim \mathcal{N}([0,0,0]', \Sigma)$, independent of X_i. The model parameters to be estimated are the

K by 3 matrix Π (where K is the dimension of X_i) and six parameters determining the positive semi-definite 3 by 3 matrix Σ.

Let us denote the difference between the DEU of option A and the DEU of option B for individual i in choice problem j as:

$$\Delta DEU_{ij} = DEU_{ij}^{B} - DEU_{ij}^{A} \tag{3.5}$$

If an individual chooses option B, $Y_{ij} = 1$ and it is zero otherwise. Then:

$$Y_{ij} = \mathbb{I}\{\Delta DEU_{ij} > \tau_i \varepsilon_{ij}\} \tag{3.6}$$

Using the estimated model parameters and the individual choices Y_{ij}, the ("posterior") distribution of the random coefficients η_i given X_i and the Y_{ij} can be determined using Bayes rule (see, e.g., Moffatt et al., 2015). Its density is given by:

$$P(\eta_i|y_i,X_i) = \frac{P(y_i|\eta,X_i)k(\eta,X_i)}{l(y_i,X_i)} \tag{3.7}$$

Here $l(y_i,X_i)$ is the likelihood contribution of individual i, integrating out the unobserved heterogeneity parameters. $k(\eta,X_i)$ is the estimated density of the "prior" distribution of η_i given X_i, which we assumed to be multivariate normal. $P(y_i|\eta,X_i)$ is the probability of observing choice sequence y_i given η,X_i. The mean of the posterior distribution gives the vector of predicted individual level parameters. In the empirical analysis below, these predicted parameters are used as indicators of risk aversion, time preference, and error propensity for each individual.

3.4 Data

The experiment was administered to participants of the LISS panel, managed by CentERdata at Tilburg University; see, e.g., Scherpenzeel (2011). The panel is based upon a random sample of Dutch private addresses. If an address is selected, all household members of age 16 or older are invited to participate. The panel is broadly representative for the Dutch non-institutionalized population and contains approximately 8,000 individuals. Panel participants are asked to answer different types of survey questions each month. The surveys are administered via the

Internet; respondents without a computer or Internet access are equipped with a user-friendly personal computer with limited functionality ("simPC") and with broadband internet. The LISS panel contains rich information on demographics, the economic and financial situation of the household and its members, and many other topics on which data have been collected in the past.

In our experiment we targeted households consisting of two adults who live together (married or unmarried) and in which both household members answer the survey on a regular basis. We invited a total of 3671 people and from these, we had a response rate of 82%, which means that 3012 people participated in our study and 3007 finished the tasks completely. We observed 20 households composed of same-sex partners and excluded them from our sample since their characteristics in terms of household formation or bargaining behavior might be different from those in other partnerships (and, their sample size is not big enough to make a separate analysis). We also excluded two couples who live together as roommates.

As mentioned in Section 3, respondents faced a dominated option at the end of each treatment. This option consisted of a 100% chance to receive a high amount if option B was chosen, versus a 100% chance of a low payment if option A was chosen. We observed that a proportion of people picked the dominated option multiple times. From these, we excluded a total of 133 people who chose the dominated option for each treatment. Our final sample consists of 2825 individuals. If we aggregate information at the household level (counting *complete* couples only), we end up with 1,188 couples for whom we have complete information, also on background characteristics like age and education. To our knowledge this is the largest study which is aimed at investigating couples' time and risk preferences with experimental data.

At the end of our experiment we also included qualitative questions to elicit preferences in an alternative way. To measure the respondents' attitudes towards risk, we asked the following questions taken from the literature (Dohmen et al., 2011; Charness et al., 2013; Falk et al., 2016):

- How do you see yourself? Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please give a value between 0 and 10, with 0 for "not at all willing to take risks" and 10 for "very willing to take risks".
  - How would you rate your willingness to take risks concerning financial matters?
  - your willingness to take risks... - in your occupation?

– your willingness to take risks... - during leisure and sport?

To obtain a qualitative measure of time preference, we included two questions from the literature on time discounting. The first question was first used by Charness and Viceisza (2015) in an experiment in rural Senegal. The second question relates to impulsiveness and impatience and was taken from Jamison et al. (2012). The questions were the following:

- On a scale from 0 to 10, how patient do you consider yourself to be? (10 being the most patient value)
- How much do you agree with the following: If I get money I tend to spend it too quickly (on a scale from 0 to 10).

Since our analysis focuses on financial decisions, we will use questions that specifically refer to financial matters in our analysis: the first question on risk attitudes, and the second question on time preference. These also appear to be the questions that have the largest correlation to actual financial decisions. In particular, the self-assessed willingness to take risks concerning financial matters is positively correlated with holding risky assets, and the self-reported tendency to spend money too quickly has a significantly negative correlation with the amount of financial wealth.

Table 3.1 shows some descriptive statistics of background variables and financial assets. In the analysis, we include household level variables such as household size, a binary indicator which is 1 if the household (or one of its members) invests in risky financial assets, and the amount of financial wealth of the household. The latter two variables combine both partners' assets if they have separate accounts, and are based upon the joint value of their financial assets. The table also shows the average individual characteristics of spouses such as their ages, level of education, gross monthly income, employment status and financial literacy. The level of education includes six categories defined by Statistics Netherlands and the financial literacy index is constructed from the answers to four questions regarding financial concepts.[3]

The summary statistics of our individual specific parameters, as predicted using the structural model and the experimental decisions described in the previous section, are shown in Table 3.2. We observe that women are significantly more risk averse than men, are less likely to make

[3]These survey questions are taken from the study "financial literacy"; see www.lissdata.nl.

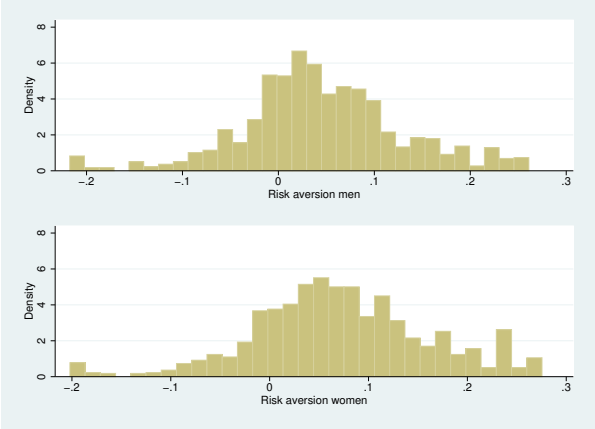
Table 3.1: Summary statistics

Variable	Mean	Std. Dev.	N
Household size	2.813	1.096	1188
Children living at home	0.799	1.088	1188
Household investments	.2066	0.405	1142
Household financial wealth	47196.81	108685.5	1028
Characteristics husband			
Age	53.857	14.877	1188
Level of education	3.83	1.456	1188
Financial literacy	2.637	1.004	730
Monthly income	3040.883	2202.035	1122
Civil servant	0.008	0.087	1173
Work	0.527	0.499	1188
Self employed	0.067	0.251	1188
Decision making	3.095037	0.648	947
Share hh income	0.700	0.201	1,109
Characteristics wife			
Age	51.348	14.834	1188
Level of education	3.481	1.458	1188
Financial literacy	2.15	0.977	720
Monthly income	1352.071	1207.697	1140
Civil servant	0.006	0.077	1174
Work	0.451	0.498	1188
Self employed	0.038	0.191	1188
Decision making	2.941922	0.682	947
Share hh income	0.300	.201	1,109

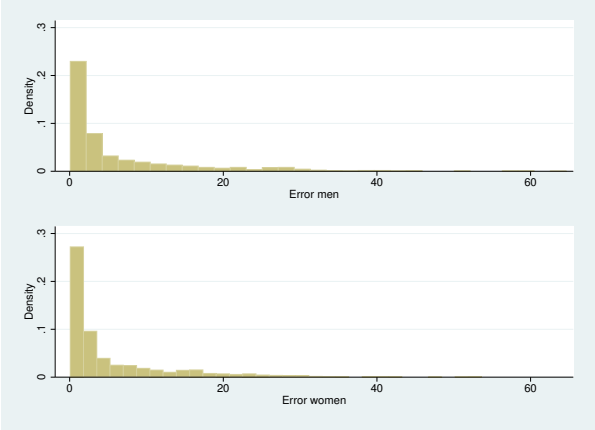
Notes: Means and standard deviations for household characteristics. Characteristics of men and women reported separately. Decision making is defined in Section 3.5 as the way in which spouses decide who takes care of the financial decisions.

mistakes, and are significantly more impatient than men. In the following section we will explore these differences further and analyze how these preferences influence household financial decision making.

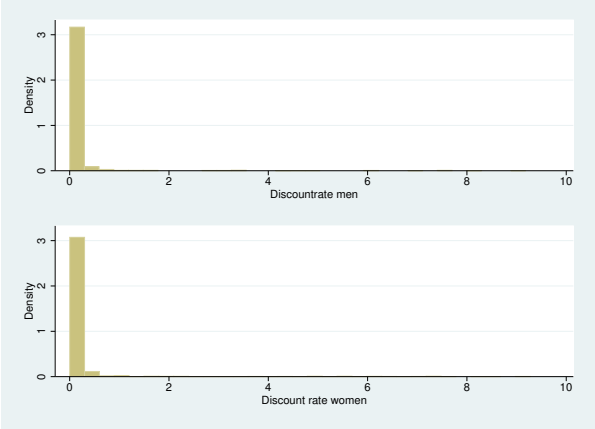
Figure 3.2 shows the distribution of the three parameters for men and women in our sample. The parameters reflecting impatience and the tendency to make the wrong decision have skewed distributions. The very high values of *error* and *time preference* reflect that a small group of respondents have a high likelihood of making mistakes and high impatience with money. In the analysis, we will use the log of these parameters to reduce the effect of outliers.



(a) Risk aversion



(b) τ



(c) Discount rate

Figure 3.2: Distribution of individual specific parameters

Table 3.2: Individual Specific Parameters

(a) Husband

Variable	Mean	Std. Dev.
Risk aversion	0.045	0.085
Error	6.385	9.206
Time preference	0.136	0.738
Risk stated	3.684	2.330
Impatience money	3.479	2.489
N	1408	

(b) Wife

Variable	Mean	Std. Dev.
Risk aversion	0.072	0.089
Error	5.459	7.756
Time preference	0.21	0.979
Risk stated	2.762	2.163
Impatience money	3.65	2.540
N	1413	

3.5 Results

3.5.1 Correlation between spouses

Table 3.3 presents the correlation coefficients between spouses' predicted individual measures for risk, time, and the (error) propensity to make suboptimal choices. The table shows that the correlation between the experimental measures of risk aversion of husband and wife is small but significantly positive. For the experimental time preference parameter, we do not find a significant correlation between spouses. Spouses' tendencies to make decision errors are positively correlated. Table 3.3 (b) shows the correlations between spouses when preferences are elicited qualitatively. Here we observe significant positive correlations for both risk and time preferences.

Table 3.3: Correlations between spouses

(a)	experimental measures			(b)	stated measures	
woman		*man*			*man*	
	risk aversion	impatience	error prop.		risk aversion	impatience
risk aversion	0.0807	-0.0086	-0.0375		0.2211	0.0719
	(0.0054)	(0.7665)	(0.1967)		(0.0000)	(0.0131)
impatience	0.0515	-0.0006	0.0401		0.091	0.1959
	(0.0763)	(0.9822)	(0.1668)		(0.0017)	(0.0000)
error prop.	-0.012	0.0479	0.1538			
	(0.6799)	(0.0988)	(0.0000)			

Notes: Correlation coefficients between measures for men and women; (a) experimental measures and (b) stated preferences. p-value in parentheses.

We observe higher correlations between both spouses' risk and time preference parameters when these are measured qualitatively. This result is in line with what Dohmen et al. (2011)

find when using domain specific elicitation of risk preferences. To validate the significance of the stated choice elicitation with respect to actual risky behavior, they look at the correlation with a lottery task. In a similar way, we found a correlation between our experimental variables and the qualitative ones: For the measures of risk aversion we find a correlation of 0.1807 for men and of 0.1881 for women. On the other hand, we find no significant correlation between our experimental and qualitative measures of impatience.

To analyze the spouses' attitudes and the correlation between them, we considered some regressions on demographic variables which have been previously found to be correlated to risk attitudes (Dohmen et al., 2012; Von Gaudecker et al., 2011; Noussair et al., 2014). These studies typically find that there are significant associations between preferences and observed demographics, although the demographics do not have a lot of predictive power. Demographics may also capture (part of) the correlations between spouses. For example, people of similar educational level or of similar age or income background tend to marry. Tables 3.9 and 3.10 in the appendix present the results for bivariate models, SUR models for the continuous experimental measures, and ordered probits for the stated preferences. The explanatory variables included in the model were level of education, number of children, individual monthly gross income and age.

Table 3.9 shows that for the three preference parameters, there exists a correlation in the error terms between spouses for each parameter. The correlation between the error terms of men and women for risk aversion and error propensity is significant. However, for impatience, we cannot reject that their errors are uncorrelated. The correlations of the error terms are very similar in size to the correlations displayed in Table 3.3. In line with existing studies, we find that higher educated individuals are less impatient and less risk averse, though the latter association is only marginally significant for men and weakly significant for women. On the other hand, for women we do find a negative correlation between impatience and personal income. Age and the number of children are not significantly associated with either risk aversion or impatience. We find strong associations with the error propensities: lower educated and older respondent have a much larger tendency to make suboptimal choices in the experiment, in line with the findings in Von Gaudecker et al. (2011) and Tanaka and Munro (2014). Table 3.10 contains a bivariate ordered probit model of stated preferences for risk and impatience. Risk taking is positively correlated to higher education for men and weakly correlated for women. Impatience is significantly negatively correlated to age for women; older women state to be more patient. This is in line with what Falk et al. (2015) find for gender and age effects on a

measure of patience.[4]

A positive correlation between preferences of spouses may be due to positive assortative matching in the marriage market or to convergence over time. With the cross-section data we have, we cannot study convergence by following couples over time. However, an alternative way test for convergence is to use information on the duration of the relationship (number of years married or living together), available in the LISS panel.[5] For this purpose, we split the sample according to the numbers of years they have lived together; the sample median of 26 years. The results are shown in Table 3.11 in the Appendix. We find that there is a stronger correlation of risk preferences of spouses in the subsample of couples who have lived together for a longer time period, according to both the experimental and the stated measure. This difference is not significant. For time preferences, we find virtually no relation with duration of the partnership.

To summarize, this section shows that the correlation between spouses with respect to risk is significant whether we look at either revealed or stated preferences. The correlation between spouses with respect to time preferences is not significant for the experimental measure but it is significant for stated preferences. This does not really change if we control for observed demographics like age, education level and gender and consider correlations between the unobservable parts only. It seems most of the correlation of time preferences is due to assortative matching since we hardly find evidence of within-couple convergence in preferences over time.

3.5.2 Household financial wealth and portfolio choice

Spouses preferences might differ and also their relevance in financial decisions of the household.

We try to capture bargaining with respect to risk aversion and discounting preferences. With our measures of preferences and no weights, we can study the relationship between these measures and financial outcomes. However, if we weigh them by a bargaining proxy, we make their effect depend the size of their bargaining power. The weighting of preference parameters is done in a model by Euwals et al.(2004), which is based on the theory of bargaining between spouses (Chiappori, 1988, 1992); specifically on the collective models. In these models, bar-

[4]The measure presented by Falk et al. (2015) is constructed using one question from an experiment and one survey question. They weight the importance of the two to construct the level of patience.

[5]Module: family and relationships

gaining power is assigned as a weight of the utility of each member. However, collective models have been mostly applied in the context of labor and consumption decisions of (riskless) goods.

We first investigate the role of spouses' attitudes for risk and time preference in determining household ownership of risky financial assets. The dependent variable Y_i for household i is equal to 1 if at least one partner reports that he, she, or the household owns some type of risky financial assets and 0 otherwise (see Section 3.4). We specify the following probit model, in which y_i^* can be interpreted as the propensity to hold any risky financial assets for household i:

$$\begin{aligned} y_i^* = X_i^f \delta_f + X_i^h \delta_h + X_i^w \delta_w + w_i^h \gamma_i^h \mu_h + w_i^w \gamma_i^w \mu_w + \\ w_i^h r_i^h \mu_h + w_i^w r_i^w \mu_w + \\ w_i^h \tau_i^h \mu_h + w_i^w \tau_i^w \mu_w + \varepsilon_i \end{aligned} \tag{3.8}$$

$$Y_i = \begin{cases} 0 \quad \text{if} \quad y_i^* \leq 0 & \text{(does not own risky financial assets),} \\ 1 \quad \text{if} \quad y_i^* > 0 & \text{(owns risky financial assets).} \end{cases}$$

Here the vectors X^f, X^h and X^w consist of family, husbands' and wives' characteristics respectively. Scalars (w_i^h, w_i^w) denote the weights which multiply the individual attitudes and (μ_h, μ_w) denote the parameters of the effect of attitudes on the probability of holding a risky asset. We constructed the weights in two ways: as the share of contributed household income and as the stated relative decision power.

For the first specification of the weights, we define w^j as the ratio of own income divided by household income – the relative contribution of the husband or wife to the income of the household:[6]

$$w^j = \frac{inc^j}{inc^f} \tag{3.9}$$

For the second specification, we constructed weights based upon the responses to a survey on financial decision making in the household.[7] Specifically, we focus on the answers to a question on the distribution of tasks regarding financial decisions:

[6]Household income inc^f is composed of the sum of the incomes of the partners; weights add up to 1. As shown in Table 3.1, on average men provide 70% of household income, while women provide 30%.

[7]These survey questions are taken from the core study "assets"; see www.lissdata.nl. Table 3.1 shows the average response to this question by men and women.

> Here are five descriptions of how financial decisions may be taken in a household. Which of these best describes how financial decisions are taken in your household?[8]
> *1 my partner generally takes all the decisions concerning financial affairs*
> *2 my partner decides about financial affairs more often than I do*
> *3 my partner and I generally decide together about financial affairs*
> *4 I generally decide about financial affairs more often than my partner*
> *5 I generally take all the decisions about financial affairs*

We map the responses to relative weights of men and women such that $w^h + w^w = 1$. However, spouses disagree with each other in this question in approximately 25% of the cases, we take the average of the spouses responses to construct the decision making weights. For the case of men, if the average answers are $\{1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5\}$ we attach the corresponding percentage of decision making power $w \in \{0, 0.125, ..., 0.875, 1\}$. The decision making power for women is defined as $1 - w$. To better understand how we assigned the weights ,consider for example, if a man answers 1 and his partner answers 5, they both agree and the weights are 0 and 1, respectively. If another man would answer 4 and his partner 3, we take the average 3.5 and assign him a value of 0.625 as weight. Separately, in a sensitivity analysis we take men's or women's answers only to construct the weights.

We depict the distributions of women's weights in Figure 3.3. Income weights of women reflect the fact that men are the main income earners. Weights according to the survey question are mostly concentrated in the middle, with a median of 0.5, representing equal decision power. The correlation between these two measures of bargaining is $\rho = 0.1042$ (p =0.0019).

We expect that people who take financial decisions jointly and who share their resources have most interaction in terms of bargaining since they have to agree on how to spend and invest their money. The percentage of people stating shared decision making power in financial affairs is around 66.21% and around 58.61% state that they manage their finances together with no separate reserves.

In a study of household decision making, Carlsson et al. (2012) show that for Chinese households, husbands have stronger influence on joint decisions than wives in around 99% of their sample. However, they do not find many factors which influence this decision power, except for the husband's parents living in the same household. Other studies have found income to be a big determinant in increasing women's bargaining position, such as by Attanasio and

[8] We will refer to this question in the remainder of the text as "DM"

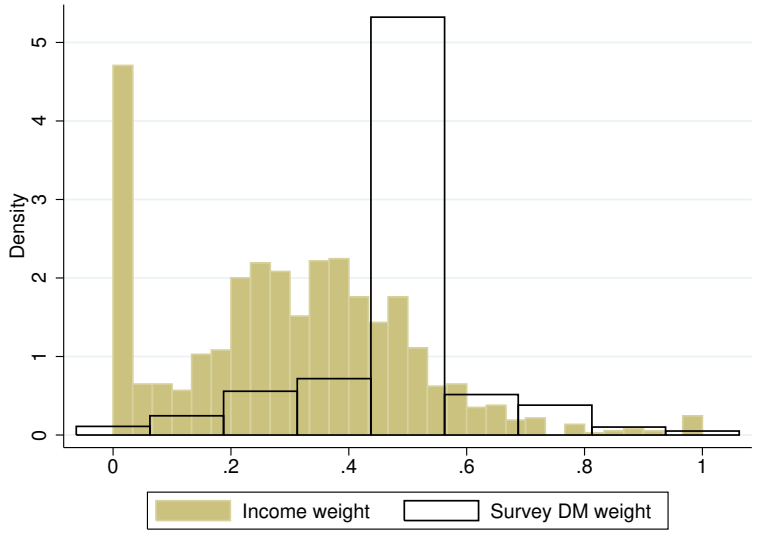


Figure 3.3: Histogram of women's bargaining weights

Lechene (2002), already mentioned in Section 3.2. To see how stated decision power is related to individual and household characteristics, we explain the male partner's decision power as measured by the categorical variable DM from characteristics such as age, education, income, financial literacy, and marital status.

Table 3.4 shows the estimates of some ordered probit models, where the regressors are differences in individual characteristics between male and female partner (age, level of education, income, financial literacy) as well as levels of household characteristics (number of kids, marital status)[9]. We find that a higher education level, income or financial literacy score, increases the likelihood of having more decision making power, in line with what we would expect (Cherchye et al., 2012; Van Rooij et al., 2011). The variable which is negatively correlated to DM is the dummy married. The probability of belonging to category 4 or 5 ("I decide more often than my partner" or "I generally take all decisions") decreases for men if the couple has a marriage contract. The number of kids is only weakly correlated to their decision style. Finally, a higher financial literacy compared to the partner increases the likelihood of having more financial decision making responsibilities.

For comparison, the right-hand panel of the table shows similar estimates for the weights

[9]We calculate the differences (husband - wife) of age, level of education, income and financial literacy score. The financial literacy score is based upon the answer to four LISS questions available in the LISS panel, from the 'Financial Literacy' project.

Table 3.4: Determinants of weights

DM Men	(1) DM w.	(2) DM w.	(3) DM w.	(4) Inc. w.	(5) Inc. w	(6) Inc. w.
Age dif	-0.004	0.007	0.003	0.197	0.297*	0.269
	(0.009)	(0.011)	(0.011)	(0.133)	(0.175)	(0.175)
Education dif	0.180***	0.161***	0.184***	3.346***	2.681***	2.911***
	(0.028)	(0.036)	(0.036)	(0.405)	(0.538)	(0.526)
Income dif / 100	0.006***	0.004	0.005			
	(0.002)	(0.003)	(0.003)			
Number of kids	0.021	0.032	0.048	2.369***	1.841**	1.932**
	(0.041)	(0.060)	(0.060)	(0.601)	(0.867)	(0.868)
Married	-0.311**	-0.467***	-0.448**	5.190***	5.689**	5.805**
	(0.122)	(0.177)	(0.176)	(1.797)	(2.671)	(2.677)
Duration partnership	-0.001	0.002	0.003	0.152***	0.118*	0.114*
	(0.003)	(0.004)	(0.004)	(0.046)	(0.063)	(0.063)
Financial literacy		0.157***			1.389**	
		(0.047)			(0.696)	
Constant				58.202***	59.491***	60.086***
				(1.655)	(2.749)	(2.739)
LR test		11.43(0.0007)				
Observations	874	541	541	1,073	620	620
R-squared				0.108	0.084	0.078

Notes: Ordered probit estimates of DM weights in Model 1,-3. Model 2 contains an index for financial literacy index differences between spouses. Age, Education and Income depict the differences between spouses. LR test shows the corresponding chi2(1) and p-value. OLS estimates of income weights in Model 4-6.

based upon personal income shares, now using a linear regression model. As we expected, higher education increases the relative contribution to the household budget. The number of kids is positively correlated with the husband earning more, which is in line with empirical evidence in the Netherlands; women tend to work part-time after having children Euwals et al. (2007).

We present in Table 3.5 the results of the probit model defined in equation 3.8. The first part of the panel contains three specifications that correspond to having no weights or different weights or preferences. The second part of the panel replicates the same models but allows for different sample sizes; the missing information on the decision making style or income makes our sample smaller. Models 1 and 4 show specifications where $w^h = 1$ and $w^w = 1$ are the attitudes' weights. Models 2 and 5 show specifications whose weights are constructed with their relative incomes (weights were defined in equation 3.9). Models 3 and 6 show results for specifications where the weights are those stated by the survey question. Because of missing

observations we also present results of those households who have answered all the relevant questions in the last three columns of Table 3.5.

Table 3.5: Probit estimations of household investments in risky assets

	(1) no weights	(2) income w	(3) stated w	(4) no weights	(5) income w	(6) stated w
Men						
Risk aversion	-1.240*	-2.452**	-1.546	-1.296*	-2.323**	-1.546
	(0.742)	(1.019)	(1.321)	(0.709)	(0.965)	(1.321)
Error propensity	-0.016**	-0.021**	-0.020	-0.016**	-0.022**	-0.020
	(0.008)	(0.011)	(0.013)	(0.007)	(0.010)	(0.013)
Impatience	-0.038	-0.076	-0.073	-0.059	-0.097	-0.073
	(0.083)	(0.092)	(0.180)	(0.084)	(0.096)	(0.180)
Women						
Risk aversion	-0.331	0.460	-2.372*	-0.788	-1.924	-2.372*
	(0.708)	(1.897)	(1.300)	(0.655)	(1.776)	(1.300)
Error propensity	-0.009	-0.016	-0.039**	-0.011	-0.027	-0.039**
	(0.009)	(0.026)	(0.018)	(0.008)	(0.024)	(0.018)
Impatience	-0.052	-0.453	-0.113	-0.074	-0.540**	-0.112
	(0.070)	(0.293)	(0.140)	(0.070)	(0.272)	(0.140)
Loglikelihood	-405.4	-404.3	-404.6	-492.1	-490.9	-404.6
Observations	886	886	886	1,069	1,067	888

Notes: Dependent variable: Ownership of risky assets(binary variable). Columns 1 and 4 show the results with $w = 1$. Columns 2 and 5 show results with relative income weights. Columns 3 and 6 show results with stated decision making power. The differences between 1-4, 2-5 and 3-6 are the number of observations included in the estimations. In the first three columns we restrict the sample to have the same number of observations in all specifications. This makes the models' likelihood contributions comparable. The next three columns contain all observations possible for each specification. Robust standard errors in parentheses.

A greater curvature of the utility function as predicted by the risk aversion coefficient of husbands and wives decreases the probability that a household owns risky investments. When we include the relative incomes as weights for individual preferences (Model 2 and 5), we see an increase in the effect of the husband's risk attitudes. Specifications 3 and 6 show the results for modeling the weights according to their responses to a survey question. Here, we observe a shift in the significance of risk aversion from men towards women.

The propensity to make mistakes is significant for men in the first two specifications. Again, as with risk aversion, once we weigh preferences by the stated measure DM, women's propen-

sity to make suboptimal choices become significant. Model 5, which includes a higher number of observations, shows an effect of women's impatience on the propensity to invest. This effect could be explained by women being more interested in present consumption, for example, on household expenses or on children's expenses as found in Lundberg et al. (2015). In Table 3.12 in the Appendix we show that across models, controls like higher vocational education and University education of husbands are highly significant in predicting the probability of investment as compared to having (less) than a high school degree.

As a comparison between experimental and survey measures, Table 3.13 in the Appendix presents the results for the analysis with stated preferences instead. The positive signs on the risk parameters reflect the willingness to take risks. Therefore, more willingness to take risk increases the probability of investment on average of both men and women. In this case, the stated willingness to take risks for women is weakly significant across different specifications. Stated impatience towards spending money is negatively correlated to investments for men. The question regarding impatience might reflect the impulse of spending money whereas the discount rate might have different components aside from impulse. This implies that in real life, this characteristic captures financial behavior well.

Next, we define financial wealth as the sum of financial assets and money currently accumulated in their bank accounts. We expected more impatient people to have less financial wealth since they would tend to be less forward looking and discount the future more heavily than those who are less impatient. We analyzed the relationship between the amount of financial wealth and the predicted risk and time preferences of husbands and wives with a tobit model since there is a significant amount of households who state to have zero financial wealth.

In all specifications of Table 3.6, we find that husbands' risk and time preferences are significantly correlated to the amount of financial wealth of the household. Conversely, we see that only in the Model 3, with stated weights, wives risk and time preferences are significant in predicting the amount of wealth accumulated by the household. The sign of the effect of the time preference parameter is negative in all cases. Therefore, the more impatient men or women are, the lower is the amount of financial wealth that is accumulated.

If we instead use the stated preferences to predict the amount of financial wealth, we find that impatience of men is the most significant predictor among the individual preferences. This result is significant in each bargaining specification. Only in the last specification, the parameters of risk aversion are weakly significant for women.

Table 3.6: Tobit estimations of household financial wealth

	(1)	(2)	(3)	(4)	(5)	(6)
Log savings	unweighted	income w	stated w	unweighted	income w	stated w
Men						
Risk aversion	-7.978***	-10.309***	-11.092**	-5.266**	-4.864	-11.806**
	(2.689)	(3.624)	(4.875)	(2.602)	(3.489)	(4.879)
Error prop.	-0.096***	-0.119***	-0.148***	-0.086***	-0.088**	-0.153***
	(0.027)	(0.036)	(0.049)	(0.026)	(0.034)	(0.049)
Impatience	-1.115***	-1.408***	-2.149***	-1.132***	-1.400***	-2.166***
	(0.267)	(0.327)	(0.554)	(0.278)	(0.342)	(0.556)
Women						
Risk aversion	-2.130	3.765	-9.385**	-3.772	-4.691	-9.536**
	(2.519)	(6.750)	(4.492)	(2.455)	(6.334)	(4.503)
Error prop.	-0.024	-0.103	-0.107*	-0.048	-0.221***	-0.104*
	(0.030)	(0.081)	(0.055)	(0.030)	(0.080)	(0.055)
Impatience	-0.416**	-0.969	-0.997**	-0.383**	-1.013	-0.938**
	(0.189)	(0.720)	(0.389)	(0.182)	(0.677)	(0.389)
Loglikelihood	-2307.06	-2307.07	-2307.99	-2753.39	-2748.56	-2313.78
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	872	872	872	1,047	1,045	874

Notes: Dependent variable: Financial wealth in euros. Column 1 shows the results with $w = 1$. Columns 2 shows results with relative income weights. Column 3 shows results with stated decision making power.

The role of income for bargaining power has been found by other studies to be significant in the household bargaining context. For example, Cherchye et al. (2012) find that bargaining weights vary with wages as well as non-labor income. In a more recent study by Cherchye et al. (2016), on intra-household allocation, they find (again) that when the wife's relative income goes up, her intra-household bargaining position improves. In our specifications where we take into account relative income as bargaining weight, we obtain more precise estimates of the coefficients on the risk aversion parameter and an improvement in the value of the likelihood function of regressions which explain the investment decision of households. However, we do no observe an improvement in the model when we analyze financial wealth of households.

3.6 Summary and conclusion

In summary, we studied the relationship between risk and time preferences between spouses from a representative sample of the Dutch population. We first elicited preferences by means of lottery choices and qualitative questions implemented in an Internet experiment. We estimated parameters of risk aversion, discounting and propensity to make suboptimal choices. We estimated a structural model with simulated maximum likelihood (SMLE) and calculated predictions using Bayes rule to compute posterior distributions at the individual level. We show that with our experimental design and structural modeling of preferences, we are able to capture preferences which are correlated to actual decision making of couples.

We found a weak positive correlation between spouse's predictions of risk aversion and no significant correlation between their time preference parameters. Conversely, when we looked at their stated preferences, we found stronger correlations for both dimensions. This could be the result of noise coming from the lottery tasks due to its complexity. It is also likely that the qualitative question related to impatience with money is capturing other aspects of intertemporal decision which are correlated between spouses.

Our findings on the analyses of portfolio decisions of households are summarized as follows. The majority of couples in our sample, claim to make joint financial decisions and share most of the resources. Based on this information we expected to observe some type of bargaining with respect to risk driven by their individual tastes. First, we constructed a model which incorporates both characteristics of spouses and household level characteristics. We found preferences for risk to be significant in predicting the likelihood of investing in risky assets; i.e, more risk averse individuals are less likely to invest in risky assets. When we analyzed the amount of financial wealth, we found the parameters of time preference to be highly significant in predicting the level of savings of the household.

To study whether introducing measures for bargaining power would improve our household decision making model, we introduced two types of bargaining weights to their corresponding preferences. Without controlling for bargaining power, we see that only the husbands' preferences are represented in the household variable of investment in risky assets. However, once we weighed preferences, we found that the wives' preferences also appear to be significant. The model with the best likelihood is the one with the weights corresponding to the share of income contributed to the household. We can conclude that given the structure of decision making,

both spouses' preferences are behind risky decision making once we control for their bargaining power. Nevertheless, results are sensitive to the exact measure of bargaining power which is used. The role of income on bargaining power has been found by other studies to have a significant impact in the household bargaining context. For example, Cherchye et al. (2012) find that bargaining weights vary with wages as well as non-labor income. In a more recent study by Cherchye et al. (2016), on intra-household allocation, they find (again) that when the wife's relative income goes up, her intra-household bargaining position improves.

Finally, we studied households' financial wealth and found that our predicted discount rate of men and women are negatively correlated to their financial wealth accumulated. However, including measures of bargaining to preferences does not improve our likelihood values.

Our study shows how experimental data of risk aversion and time preference can be used to understand household financial decision making. We observe that couples have similar risk attitudes. We show that if bargaining power stems from the relative income contribution, men's preferences are more likely to influence financial decisions since they are the primary earners in our sample. This is an important insight to policy makers that aim to increase female participation in financial markets. It means that increasing female labor participation, and wages, would translate to more power in the household. However, as we showed, other mechanisms matter for increasing bargaining power, such as financial literacy and education differences among spouses. Further research should be directed at understanding how risk and time preference interact among spouses in a bargaining context, allowing for different 'types' of couples to differ in their bargaining styles.

Appendix

The lottery experiment consisted of four treatments in the gains domain with five choices in each treatment. In each treatment each individual must decide between two lotteries which vary in probability throughout the treatment but do not vary in payoffs. The lottery A had a lower variance than lottery B and the expected payoff became larger as one proceeds down the list, but the expected value of lottery B grows larger relative to that of lottery A. Each screen contains five choices and pie charts illustrating the probabilities. Thus each subject has to choose in total 20 times and these choices will be used to estimate their preferences.

The treatments differed in terms of the amounts in euros that could be earned, and in terms of the time periods in which these payments would take place. Table 4.7 shows the experimental design in more detail (the probabilities and quantities used to elicit preferences). This table also shows the expected value of each lottery and which choice a risk neutral individual would take. The subject chooses A or B in each row and one of these is at the end selected at random for actual payment. We tell the subjects at the beginning of the experiment that they have a 1/10 probability of getting paid and at the end they know whether they were selected or not. This has been seen in the literature as a good strategy to keep the tasks incentive compatible while keeping the costs for the experimenter low (Dohmen et al. (2010)). The average payoffs were 13.4 euros with a standard deviation of approximately 7 euros.

In Figure 3.4 we present an example of a screen that subjects faced during one of the treatments.

We designed the choice lists with enough variation in its different dimensions such that we would be able to identify individual preferences. Before taking the experiment to the field, we ran simulations assuming a structural form of the utility function and parameters to ensure the identifiability of the preference parameters.

Figure 3.4: Screen shot example

Table 3.7: Details of the experimental design

Treatment	$p_{\mathbf{A}}$	$\$_{\mathbf{Ah}}$	$p_{\mathbf{A}}$	$\$_{\mathbf{Al}}$	**EVA**	$p_{\mathbf{B}}$	$\$_{\mathbf{Bh}}$	$p_{\mathbf{B}}$	$\$_{\mathbf{Bl}}$	**EVB**	**EVA-EVB**
Timing		6 months					3 months				
I	0.15	11	0.85	9	9.3	0.15	23	0.85	0	3.45	5.85
	0.3	11	0.7	9	9.6	0.3	23	0.7	0	6.9	2.7
	0.5	11	0.5	9	10	0.5	23	0.5	0	11.5	-1.5
	0.85	11	0.15	9	10.7	0.85	23	0.15	0	19.55	-8.85
	1	11	0	9	11	1	23	0	0	23	-12
Timing		9 months					6 months				
II	0.15	15	0.85	10	10.75	0.15	29	0.85	4	7.75	3
	0.3	15	0.7	10	11.5	0.3	29	0.7	4	11.5	0
	0.5	15	0.5	10	12.5	0.5	29	0.5	4	16.5	-4
	0.85	15	0.15	10	14.25	0.85	29	0.15	4	25.25	-11
	1	15	0	10	15	1	29	0	4	29	-14
Timing		3 months					0 months				
III	0.15	20	0.85	15	15.75	0.15	25	0.85	2	5.45	10.3
	0.3	20	0.7	15	16.5	0.3	25	0.7	2	8.9	7.6
	0.5	20	0.5	15	17.5	0.5	25	0.5	2	13.5	4
	0.85	20	0.15	15	19.25	0.85	25	0.15	2	21.55	-2.3
	1	20	0	15	20	1	25	0	2	25	-5
Timing		3 months					6 months				
IV	0.15	12	0.85	7	7.75	0.15	22	0.85	0	3.3	4.45
	0.3	12	0.7	7	8.5	0.3	22	0.7	0	6.6	1.9
	0.5	12	0.5	7	9.5	0.5	22	0.5	0	11	-1.5
	0.85	12	0.15	7	11.25	0.85	22	0.15	0	18.7	-7.45
	1	12	0	7	12	1	22	0	0	22	-10

Notes: Each treatment consisted of five possible choices. $P_{A,B}$ are the probabilities of choice A, B with high and low payoff. EVA: Expected value of option A; EVB: Expected value of option B. The last column shows the difference between EVA and EVB. Each treatment varied in the timing of the payoffs from 0 to 9 months.

Table 3.8: Summary Statistics of Choices

Choice	Mean	Std. Dev.
choice1 t1	0.216058	0.411625
choice2 t1	0.242936	0.428931
choice3 t1	0.436251	0.496005
choice4 t1	0.688146	0.46333
choice5 t1	0.869056	0.337397
choice1 t2	0.34011	0.473828
choice2 t2	0.42419	0.494305
choice3 t2	0.660924	0.473477
choice4 t2	0.814611	0.38868
choice5 t2	0.900069	0.29996
choice1 t3	0.191247	0.393351
choice2 t3	0.198484	0.398927
choice3 t3	0.279462	0.448812
choice4 t3	0.50448	0.500066
choice5 t3	0.816678	0.386997
choice1 t4	0.198484	0.398927
choice2 t4	0.230186	0.421024
choice3 t4	0.414197	0.492668
choice4 t4	0.660234	0.473711
choice5 t4	0.834252	0.371918

Notes: Means and standard deviations of each choice.

Table 3.9: SUR regressions of individual attitudes

	(1) Risk men	(2) Risk wom	(3) Error men	(4) Error wom	(5) Impat. men	(6) Impat. wom
Age						
25-34	-0.009	-0.015	3.103	2.042	0.031	0.028
	(0.026)	(0.017)	(2.739)	(1.419)	(0.223)	(0.187)
35-44	0.006	-0.004	3.617	1.361	0.046	-0.078
	(0.026)	(0.017)	(2.729)	(1.433)	(0.223)	(0.188)
45-54	0.010	-0.000	3.976	1.723	0.119	-0.074
	(0.026)	(0.017)	(2.721)	(1.396)	(0.222)	(0.184)
55-64	0.004	0.008	4.693*	2.707**	0.128	0.119
	(0.026)	(0.016)	(2.684)	(1.349)	(0.219)	(0.177)
>65	0.009	-0.018	5.070*	5.621***	0.145	-0.065
	(0.026)	(0.016)	(2.668)	(1.373)	(0.218)	(0.180)
Education						
Intermed Voc	-0.007	-0.012*	-1.476**	-0.190	-0.144***	-0.207***
	(0.006)	(0.007)	(0.676)	(0.589)	(0.055)	(0.078)
Higher Voc	-0.019***	-0.007	-2.363***	-1.871***	-0.198***	-0.312***
	(0.007)	(0.007)	(0.691)	(0.598)	(0.056)	(0.079)
University	-0.009	-0.015	-4.194***	-2.712***	-0.227***	-0.252**
	(0.009)	(0.011)	(0.915)	(0.900)	(0.075)	(0.118)
Number of kids	-0.000	-0.000	-0.191	-0.191	0.002	-0.007
	(0.003)	(0.003)	(0.310)	(0.262)	(0.025)	(0.034)
Log of income	-0.004	0.000	0.169	-0.112	-0.001	-0.024**
	(0.003)	(0.001)	(0.295)	(0.086)	(0.024)	(0.011)
Constant	0.081**	0.083***	2.384	4.024***	0.146	0.503***
	(0.032)	(0.016)	(3.315)	(1.361)	(0.270)	(0.179)
Correlation	0.0718		0.1015		-0.036	
Breusch-Pagan	5.726		11.442		1.658	
Observations	1,111	1,111	1,111	1,111	1,111	1,111
R-squared	0.016	0.016	0.039	0.085	0.022	0.034

Notes: Level of education is included as a categorical variable which ranges from 1 (primary) to 6 (university). Age categories are split into 6 groups. Income is transformed as the natural logarithm of the monthly gross individual income.

Table 3.10: Bivariate ordered probit of stated preferences

	(1)	(2)	(3)	(4)
	Risk men	Risk women	Impat. men	Impat. women
Education				
Intermed Voc	0.025	0.015	-0.069	0.107
	(0.078)	(0.081)	(0.079)	(0.082)
Higher Voc	0.233***	0.156*	-0.065	0.013
	(0.079)	(0.082)	(0.081)	(0.083)
University	0.227**	0.156	-0.280***	-0.271**
	(0.105)	(0.123)	(0.107)	(0.125)
Age				
25-34	-0.109	0.004	-0.102	-0.423**
	(0.312)	(0.194)	(0.318)	(0.197)
35-44	-0.245	-0.013	-0.353	-0.460**
	(0.312)	(0.197)	(0.317)	(0.199)
45-54	-0.280	0.070	-0.444	-0.691***
	(0.311)	(0.192)	(0.317)	(0.194)
55-64	-0.310	-0.083	-0.563*	-0.933***
	(0.306)	(0.185)	(0.312)	(0.188)
>65	-0.244	-0.184	-0.699**	-1.101***
	(0.305)	(0.189)	(0.311)	(0.192)
Number of kids	0.015	-0.020	0.009	0.014
	(0.036)	(0.037)	(0.036)	(0.037)
Log of income	0.005	0.010	0.059*	0.014
	(0.033)	(0.012)	(0.035)	(0.012)
Constant	0.260***		0.162***	
	(0.032)		(0.032)	
rho	0.255		0.161	
	(0.029)		(0.31)	
Observations	1,111	1,111	1,111	1,111

Notes: Level of education is included as a categorical variable with base level as primary and secondary education. Age categories are split into 6 groups of ten years each. Income is transformed as the natural logarithm of the monthly gross individual income.

Table 3.11: Correlation of preferences and duration of partnership

men	risk aversion			impatience	
women	dur < 26	dur > 26		dur < 26	dur > 26
risk aversion	0.0657	0.0823	impatience	-0.0172	-0.0030
pval	0.1245	0.0422	*pval*	0.6872	0.9405
obs	548	609	*obs*	548	609
men	risk stated			impatience stat.	
women	dur < 26	dur > 26		dur < 26	dur > 26
risk stated	0.1905	0.2447	impatience stat.	0.1719	0.1770
pval	0.0000	0.0000	*pval*	0.0001	0.0000
obs	548	609	*obs*	548	609

Notes: Correlation coefficients are displayed with corresponding p-values and number of observations. There are 31 observations for people with marriage duration = 26 years.

Table 3.12: Investment decisions and revealed preferences

hh investments	no weights	income w	stated w	no weights	income w	stated w
Men						
25-34	-0.646	-0.648	-0.665	-0.008	-0.002	-0.665
	(0.715)	(0.711)	(0.715)	(0.680)	(0.687)	(0.715)
35-44	-0.134	-0.138	-0.161	0.153	0.158	-0.161
	(0.749)	(0.744)	(0.750)	(0.718)	(0.725)	(0.750)
45-54	-0.505	-0.521	-0.522	-0.106	-0.107	-0.522
	(0.804)	(0.800)	(0.803)	(0.750)	(0.757)	(0.803)
55-64	-0.158	-0.189	-0.184	0.145	0.130	-0.184
	(0.818)	(0.815)	(0.817)	(0.767)	(0.775)	(0.817)
>65	-0.418	-0.445	-0.437	0.001	-0.020	-0.437
	(0.837)	(0.834)	(0.835)	(0.785)	(0.791)	(0.835)
Intermed Voc Ed	-0.053	-0.051	-0.051	-0.009	0.001	-0.051
	(0.140)	(0.141)	(0.140)	(0.128)	(0.128)	(0.140)
Higher Voc Ed	0.455***	0.452***	0.445***	0.410***	0.413***	0.445***
	(0.143)	(0.143)	(0.141)	(0.130)	(0.129)	(0.141)
University	0.684***	0.667***	0.674***	0.598***	0.595***	0.674***
	(0.204)	(0.204)	(0.202)	(0.169)	(0.169)	(0.202)
Risk aversion	-1.240*	-2.452**	-1.546	-1.296*	-2.323**	-1.546
	(0.742)	(1.019)	(1.321)	(0.709)	(0.965)	(1.321)
Error propensity	-0.016**	-0.021**	-0.020	-0.016**	-0.022**	-0.020
	(0.008)	(0.011)	(0.013)	(0.007)	(0.010)	(0.013)
Impatience	-0.038	-0.076	-0.073	-0.059	-0.097	-0.073
	(0.083)	(0.092)	(0.180)	(0.084)	(0.096)	(0.180)
Log income	0.212	0.238*	0.210*	0.132	0.126	0.210*
	(0.129)	(0.144)	(0.127)	(0.090)	(0.099)	(0.126)
Women						
25-34	-0.098	-0.098	-0.060	-0.182	-0.183	-0.060
	(0.453)	(0.458)	(0.458)	(0.412)	(0.422)	(0.458)
35-44	0.158	0.159	0.192	0.285	0.283	0.192
	(0.504)	(0.508)	(0.509)	(0.458)	(0.466)	(0.509)
45-54	0.504	0.525	0.530	0.428	0.439	0.529
	(0.572)	(0.577)	(0.574)	(0.506)	(0.514)	(0.574)
55-64	0.684	0.706	0.734	0.731	0.747	0.733
	(0.597)	(0.603)	(0.599)	(0.530)	(0.540)	(0.599)
>65	0.699	0.727	0.742	0.687	0.714	0.742
	(0.621)	(0.626)	(0.622)	(0.556)	(0.565)	(0.622)
Intermed Voc Ed	0.016	0.016	0.010	-0.018	-0.013	0.011
	(0.136)	(0.135)	(0.135)	(0.126)	(0.126)	(0.135)
Higher Voc Ed	-0.058	-0.066	-0.063	-0.021	-0.018	-0.063
	(0.143)	(0.144)	(0.143)	(0.131)	(0.131)	(0.143)
University	0.092	0.119	0.084	0.198	0.220	0.084
	(0.233)	(0.232)	(0.232)	(0.191)	(0.192)	(0.232)
Risk aversion	-0.331	0.460	-2.372*	-0.788	-1.924	-2.372*
	(0.708)	(1.897)	(1.300)	(0.655)	(1.776)	(1.300)
Error propensity	-0.009	-0.016	-0.039**	-0.011	-0.027	-0.039**
	(0.009)	(0.026)	(0.018)	(0.008)	(0.024)	(0.018)
Impatience	-0.052	-0.453	-0.113	-0.074	-0.540**	-0.112
	(0.070)	(0.293)	(0.140)	(0.070)	(0.272)	(0.140)
Log income	0.086***	0.078***	0.086***	0.083***	0.089***	0.086***
	(0.023)	(0.026)	(0.023)	(0.021)	(0.024)	(0.023)
Constant	-3.127***	-3.316***	-3.067***	-2.807***	-2.823***	-3.069***
	(1.097)	(1.166)	(1.081)	(0.875)	(0.906)	(1.077)
Observations	886	886	886	1,069	1,067	888
Loglikelihood	-405.4	-404.3	-404.6	-492.1	-490.9	-404.6

Notes: Dependent variable: observed investment binary. The base category in education level is primary. Wealth = savings balance, value of investments, value of loans. The weights consist of the share in total income of each spouse. Column 2 and 4 contain preferences weighted by their share of income. Age is a categorical variable (1-6) Robust standard errors in parentheses.

Table 3.13: Household investments and stated preferences

	(1)	(2)	(3)
hhinv	unweighted	income w	stated w
Men			
Risk stated	0.109***	0.148***	0.219***
	(0.024)	(0.032)	(0.040)
Impatience	-0.066***	-0.110***	-0.102**
	(0.024)	(0.034)	(0.045)
Women			
Risk stated	0.046*	0.172**	0.083*
	(0.025)	(0.068)	(0.047)
Impatience	-0.021	0.018	-0.067
	(0.024)	(0.063)	(0.045)
Loglikelihood	-2532	-2488	-2487
Controls	Yes	Yes	Yes
Observations	935	935	935

Notes: Preferences for risk and patience are measured according to the survey questionnaire.

Table 3.14: Financial wealth and revealed preferences

logfinwealth	(1)	(2)	(3)	(4)	(5)	(11)
Men	no weights	income w	stated w	no weights	income w	stated w
25-34	0.702	0.854	0.646	1.550	1.556	0.770
	(2.554)	(2.561)	(2.554)	(2.102)	(2.103)	(2.559)
35-44	2.424	2.488	2.255	3.128	3.174	2.166
	(2.666)	(2.674)	(2.667)	(2.249)	(2.248)	(2.674)
45-54	2.602	2.596	2.447	3.104	3.079	2.336
	(2.756)	(2.761)	(2.757)	(2.341)	(2.339)	(2.765)
55-64	4.356	4.330	4.173	4.982**	4.963**	4.089
	(2.835)	(2.838)	(2.837)	(2.438)	(2.436)	(2.845)
>65	4.611	4.505	4.492	5.448**	5.297**	4.379
	(2.896)	(2.898)	(2.898)	(2.510)	(2.506)	(2.906)
Intermed Voc Ed	-0.014	0.005	0.065	0.234	0.312	0.036
	(0.481)	(0.480)	(0.479)	(0.463)	(0.462)	(0.481)
Higher Voc Ed	0.507	0.579	0.578	0.609	0.754	0.555
	(0.504)	(0.502)	(0.503)	(0.491)	(0.491)	(0.501)
University	0.541	0.603	0.647	1.040	1.151*	0.675
	(0.727)	(0.728)	(0.726)	(0.669)	(0.670)	(0.724)
Risk aversion	-7.978***	-10.309***	-11.092**	-5.266**	-4.864	-11.806**
	(2.689)	(3.624)	(4.875)	(2.602)	(3.489)	(4.879)
Error prop.	-0.096***	-0.119***	-0.148***	-0.086***	-0.088**	-0.153***
	(0.027)	(0.036)	(0.049)	(0.026)	(0.034)	(0.049)
Impatience	-1.115***	-1.408***	-2.149***	-1.132***	-1.400***	-2.166***
	(0.267)	(0.327)	(0.554)	(0.278)	(0.342)	(0.556)
Log income	0.649***	0.764***	0.636***	0.554***	0.532**	0.554**
	(0.242)	(0.275)	(0.243)	(0.194)	(0.230)	(0.218)
Women						
25-34	-2.427*	-2.426*	-2.254	-2.245*	-2.356*	-2.000
	(1.419)	(1.425)	(1.422)	(1.294)	(1.298)	(1.418)
35-44	-3.199**	-3.206**	-2.972*	-3.148**	-3.250**	-2.731*
	(1.594)	(1.598)	(1.597)	(1.474)	(1.478)	(1.594)
45-54	-2.499	-2.424	-2.296	-2.478	-2.473	-2.083
	(1.732)	(1.736)	(1.736)	(1.608)	(1.611)	(1.732)
55-64	-3.648**	-3.609*	-3.366*	-3.404*	-3.474**	-3.153*
	(1.847)	(1.850)	(1.854)	(1.735)	(1.736)	(1.852)
>65	-2.128	-1.893	-1.903	-1.708	-1.539	-1.682
	(1.936)	(1.940)	(1.940)	(1.832)	(1.834)	(1.939)
Intermed Voc Ed	0.161	0.214	0.088	0.381	0.447	0.080
	(0.501)	(0.499)	(0.501)	(0.482)	(0.479)	(0.502)
Higher Voc Ed	0.998*	0.952*	0.914*	0.908*	0.961*	0.908*
	(0.528)	(0.527)	(0.527)	(0.504)	(0.502)	(0.528)
University	1.839**	1.839**	1.722**	1.020	1.160	1.637*
	(0.865)	(0.862)	(0.865)	(0.778)	(0.775)	(0.865)
Risk aversion	-2.130	3.765	-9.385**	-3.772	-4.691	-9.536**
	(2.519)	(6.750)	(4.492)	(2.455)	(6.334)	(4.503)
Error prop.	-0.024	-0.103	-0.107*	-0.048	-0.221***	-0.104*
	(0.030)	(0.081)	(0.055)	(0.030)	(0.080)	(0.055)
Impatience	-0.416**	-0.969	-0.997**	-0.383**	-1.013	-0.938**
	(0.189)	(0.720)	(0.389)	(0.182)	(0.677)	(0.389)
Log income	0.046	-0.005	0.048	0.043	0.090	0.041
	(0.070)	(0.085)	(0.070)	(0.068)	(0.082)	(0.069)
Constant	2.145	1.082	2.228	1.573	1.010	2.831
	(2.932)	(3.035)	(2.933)	(2.338)	(2.456)	(2.842)
Observations	872	872	872	1,047	1,045	874

Notes: Dependent variable: Financial wealth. The base category in education level is secondary or less. Age is represented in age bracket dummies, 18-24 is the base category.

Table 3.15: Household savings choices and stated preferences

	(1)	(2)	(3)
Log savings	unweighted	income w	stated w
Men			
Risk stated	0.062	0.042	0.225
	(0.084)	(0.109)	(0.146)
Impatience	-0.156**	-0.217**	-0.248*
	(0.077)	(0.104)	(0.146)
Women			
Risk stated	-0.078	0.035	-0.312*
	(0.090)	(0.244)	(0.168)
Impatience	0.036	-0.079	-0.041
	(0.078)	(0.204)	(0.144)
Controls	Yes	Yes	Yes
Observations	905	905	905

Notes: Tobit regression of the natural logarithm of financial wealth at the household level. Explanatory variables are stated risk taking and impatience. We control for age category dummies, education level dummies and log gross individual income.

4 | Stability of Risk and Time Preferences of Individuals and Couples

4.1 Introduction

The vast literature on the analysis of individuals' risk and time preferences has mainly focused on cross-sectional analysis. Less is known regarding the stability of these preferences. Do preferences change over time, and, if so, how? Do they vary in response to, for example, economic or health shocks? Economists traditionally assume that preferences are economic primitives that are stable over time. This helps to identify the causal effects of shocks (i.e., changes in budget constraints or prices) on observed behavior. If preferences and the environment are changing simultaneously, it would be much less straightforward to identify such causal effects.

So far, the literature seems to point towards a limited degree of stability of risk and time preferences (Wölbert and Riedl, 2013; Meier and Sprenger, 2015; Baucells and Villasís, 2010; Harrison et al., 2005). A few studies have found low degrees of correlation between preferences elicited through experimental procedures at different points in time (Chuang and Schechter, 2015), especially compared to stated measures of the same preferences. There might be several reasons why researchers in the past have found such a low degree of correlation. One of them rests on the importance of measurement errors, which could be caused by low cognitive skills. It could also be that temporary changes in preferences play a large role, due to different types of shocks, such as health shock, job loss, a financial shock, etc.

Most of the existing studies focus their attention on stability of individual preferences. If, however, individuals live in a multi-person household, then shocks to one member might also have an effect on the rest of the family. In fact, previous research has shown that when studying

decision making, preferences among household members are positively correlated among them (Abdellaoui et al., 2013).

We contribute to the literature by analyzing the correlation between preferences elicited in two separate choice experiments that were conducted 18 months apart among a representative sample of Dutch couples. We first focus our attention on stability at the individual level, but also study possible cross-spousal effects in couples. The experiments consisted of choice problems designed to elicit risk as well as time preferences at the individual level. Using this choice data, we calculated individual predictions of risk aversion and time preference parameters fore each wave. Moreover, our econometric model incorporates the individual's tendency to make suboptimal choices. We study the associations between shocks to health, employment, and (current and expected) financial situation and changes in preferences between the two time periods. Finally, we also study the relationship between such shocks and changes in preferences of the spouse. To our knowledge this is the first analysis of this type with experimental data and a detailed set of socioeconomic variables for a large representative panel of couples.

We find that there are a few individual shocks that are associated with the variability of preferences. These characteristics are mainly those related to employment status. We distinguished between types of non-employment (job seeker, work disability, etc.) and find a negative correlation between a transition to unemployment with active job search and risk aversion. We also found that people who become homemakers on average also become more patient. Moreover, health changes are associated with a qualitative measure of impatience, but not with the experimental measure.

Our findings also point towards a cross-couple effect of women's unemployment, specifically when going into work disability, on risk aversion and time preferences of men. The only cross-effect that we observe on women is caused by a change in the financial satisfaction on men. Women make significantly less mistakes in the experiments when men claim to be better off financially. On the other hand, if we look at stated preferences, we find that as women's economic expectations worsen, men become more risk averse.

The remainder of the paper is organized as follows. Section 4.2 we summarize briefly the findings of the literature so far. Section 4.3 presents the description of the experimental methodology and summary statistics of the data. Next, we show our results in Section 4.4. Finally, section 4.5 summarizes and concludes.

4.2 Related literature

In recent years several studies on stability of preferences have appeared, thanks to the availability of repeated experiments or survey measures. This concerns, to name a few, preferences for risk taking and intertemporal decisions. The literature can be organized according to the time periods which they consider for stability and whether the elicitation of preferences is a result of qualitative or experimental measures.

Some studies which study risk and time preferences with experimental measures have found that changes in these can be correlated to some observed sociodemographic variables and to measurement errors. For example, Andersen et al. (2008) analyze risk preferences elicited through lottery experiments and look at changes in risk preferences during a 17 month period for a sample covering the Danish population. They find that preferences are rather stable, but subject to changes due to the subject's state of personal finances. We will show that instability in risk attitudes of the adult Dutch population is mostly driven by changes in their employment status and associated with changes in their satisfaction with the economic environment. Another study which also takes place within a short time window, is the one by Wölbert and Riedl (2013) who show the importance of testing the reliability of measures before establishing correlations between time periods. This is done to ensure that the changes are not caused solely by measurement errors. They find rather reliable measures of risk aversion and time preferences which are highly correlated in a period of 5 weeks.

Other studies elicit preferences with survey questions, such as Dohmen et al. (2016) who re-test their measures of preferences 20-53 days after the first elicitation. They report a correlation of 0.62 between stated measures of risk taking which remains stable at later periods in time; suggesting measurement error. In our study, we do not have information on preferences soon after the first elicitation, therefore we cannot distinguish directly the size of the measurement error. However, as will be shown in the next Chapters, we find similar correlations for stated risk taking. Dohmen et al. (2015) investigates changes in risk attitudes across the life course. They use qualitative survey measures collected over a large period of time for adults in Germany. They find that the stated willingness to take risks decreases over the life course. Their work shows that this type of survey questions is very powerful in getting information of risk preferences. We will compare the stability of stated preferences and experimental measures across time for a representative sample of the Dutch population.

Literature which studies longer time periods typically uses hypothetical questions. Brown et al. (2017); Perez-Padilla (2012) find that an (exogenous) increase in crime in Mexico has lead to an increase in the average level of risk aversion of those areas in which crime increased steeply. Their results point towards a possibility of environmental factors being responsible for changes in individual preferences. The literature on changes in preferences due to exceptional shocks such as natural disasters or war outbreaks is also extensive[1].

With respect to stability of time preferences, Meier and Sprenger (2015) find high correlations over time of parameters of a quasi-hyperbolic discounting function, reflecting present bias, discount rate, the propensity. They do so by estimating a quasi-hyperbolic discount function with data from an experiment among 250 people who participated twice. They observe instability for some individuals and find no correlation between preference instability and sociodemographic variables.

In a different context, Bacon et al. (2014) study the correlation of stated risk preferences between spouses over time. They estimate a bivariate panel ordered probit model, disentangling assortative mating from couple random shocks. They study multiple waves of the German SOEP regarding stated risk preferences. They find that couples have similar risk attitudes and react similarly to shocks. In this paper we will focus on shocks regarding employment, health and economic expectations and look at the cross-couple effects.

Chuang and Schechter (2015) review the literature so far on stability of risk, time, and social preferences. In addition, they perform their own analysis with data from Paraguay. They find that stability of preferences measured with qualitative survey questions are more stable than those measured quantitatively with experiments, in line with Dohmen et al. (2015).

In summary, previous research has found positive correlations between preferences elicited at different points in time. Most of these studies analyze small samples in the case of experimental studies. In the case of survey questions, the samples tend to be somewhat larger. Except for Chuang and Schechter (2015), studies focus on one preference only, whereas we will analyze risk and time preferences jointly. When people do not make the same decisions in repeated experiments, this can be due changing preferences but also to changes in the tendency to make suboptimal decisions, modeled through, for example, errors added to the difference in utility of the choice options before making a choice (Fechner errors, see, e.g., Loomes (2005)). In our analysis, we model the tendency to make such errors as a third individual specific parameter

[1] See literature overview in Perez-Padilla (2012)

and analyze its stability over time jointly with that of the risk and time preference parameters.

4.3 Experimental setup and data description

4.3.1 The experiment

In order to elicit preferences we conducted two waves of a modified Multiple Price List (MPL; see Holt and Laury (2002)) lottery choice experiment. The experiments were carried out in the LISS Panel, an ongoing Internet panel covering the adult Dutch population, including those without Internet. This panel is representative of the Dutch population ages 16 and older in terms of observable background characteristics. Panel members routinely answer questions on a variety of topics every month.[2] The LISS panel has been used several times to carry out incentivized economic experiments among a representative sample of a broad population; see, e.g., Noussair et al. (2013) and Noussair et al. (2014).

The first wave of our experiment was conducted in May 2014. The second wave took place in November 2015 under the same experimental conditions. Each experiment consisted of choices between two lotteries with varying means and variances. Subjects faced five choices per screen and were asked to make 45 choices in total. In order to make the experiment easier, we included pie charts to help people understand and picture probabilities, following Von Gaudecker et al. (2011). See Appendix A for details of the experimental design and an example of a screen shown to the respondents.

One of the lotteries is selected and resolved at random at the end for actual payment. We informed the subjects at the beginning of the experiment that they have a 1/10 probability of actually getting paid and at the end on whether they were selected for payment or not. This has been seen in the literature as a good strategy to make the tasks incentive compatible at limited costs for the experimenter (Dohmen et al. (2010)). The average payoffs were 13.4 euros with a standard deviation of approximately 7 euros. The procedure was the same in both waves.

The choices made by the respondents provide information on the curvature of their utility functions (i.e., their risk aversion) and their preferences for earlier (or later) payment (i.e., their subjective discount parameters). Moreover, internally inconsistent choice sequences point at

[2] See https://www.lissdata.nl/lissdata/

optimization errors, so that the choice sequences are also informative about the tendency to make mistakes.

After the lottery tasks we included some survey questions to gather self-reported measures of risk taking and patience. The risk questions are standard in the literature:[3]

- How do you see yourself? Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please give a value between 0 and 10, with 0 for "not at all willing to take risks" and 10 for "very willing to take risks".
  - How would you rate your willingness to take risks concerning financial matters?
  - your willingness to take risks... - in your occupation?
  - your willingness to take risks... - during leisure and sport?

To measure stated time preference or discounting, we included the following questions [4]:

- On a scale from 0 to 10, how patient do you consider yourself to be? (10 being the most patient value)
- How much do you agree with the following: If I get money I tend to spend it too quickly (on a scale from 0 strongly disagree to 10 fully agree).

4.3.2 Structural parameters of risk, error and time preference

To obtain a predicted index of risk aversion and time preference for each subject at each point in time, we follow an empirical strategy similar to that of, for example, Von Gaudecker et al. (2011). Using the information on all participants in the lottery experiment, we estimated a structural utility model that incorporates individual specific parameters for these two attitudes. To take account of possible errors in decision making, we incorporate Fechner errors. To allow

[3]For the analysis we inverted this scale in order to simplify comparing with the experimental measure – an increasing rate reflects increasing risk aversion.

[4]The first question is taken from a field experiment by Charness and Viceisza (2015) which was performed in rural Senegal (the aim of their experiment however, was to compare three risk elicitation procedures). The second question relates to impulsiveness and impatience and was taken from Jamison et al. (2012) where they also analyze possible qualitative questions. Perhaps not surprisingly, and as we will later mention, the question which most predicts economic outcomes is the one related to money.

for different tendencies to make suboptimal decisions, the variance of these errors is allowed to vary across respondents.

The three individual specific parameters for risk aversion, time preference, and error tendency, are specified using a random coefficients model. They are assumed to remain constant during the experiment. On the other hand, we estimate this model separately for wave 1 and wave 2 of the experiment and do not impose any restrictions on how the three parameters vary over time. The three parameters can vary with a small set of observed individual characteristics ("observed heterogeneity") but also contain an unobserved component ("unobserved heterogeneity").[5] The three unobserved components are allowed to be correlated.

More specifically, we assume a constant absolute risk aversion (CARA) utility function for the gains domain and exponential discounting. We also estimated a CRRA utility function, but the CARA specification gave the best fit. We also experimented with pure hyperbolic and quasi-hyperbolic discounting specifications, but found hardly any evidence of hyperbolic discounting for the average respondent. Given the computational burden of the quasi-hyperbolic model (with a fourth individual specific parameter), we decided to use the exponential specification for our analysis. The specification we use is as follows:

Utility function:

$$U(\gamma, z) = \frac{1}{\gamma}(1 - e^{-\gamma z}) \tag{4.1}$$

Discounting factor:

$$D(r,t) = e^{-rt} \tag{4.2}$$

Discounted utility of a given lottery:

$$DEU = D(r,t) * U(\gamma, z) \tag{4.3}$$

We assume respondents choose the lottery which maximizes their discounted expected utility (DEU) plus Fechner error $\tau\varepsilon$. Therefore a subject will choose lottery B if:

$$DEU^B + \tau\varepsilon_B > DEU^A + \tau\varepsilon_A \tag{4.4}$$

[5] Von Gaudecker et al. (2011) found that unobserved heterogeneity explains a much larger part of the variation in preferences than observed heterogeneity.

We assume that the ε's follow a type I extreme value distribution and are independent of each other. The difference of the errors $\varepsilon = \varepsilon_A - \varepsilon_B$ then follows a logistic distribution. The parameter τ can be interpreted as the tendency of making a suboptimal choice.

The three random coefficients are captured by a vector $\eta_i = (\gamma_i, ln(r_i), ln(\tau_i))'$. For respondent i with given observed characteristics X_i, we assume η_i is drawn from a three-variate normal distribution with arbitrary covariance matrix and means that are linear combinations of the components of X_i.

Let us denote the difference between the DEUs of options A and B in choice problem j for subject i as:

$$\Delta DEU_{ij} = DEU_{ij}^B - DEU_{ij}^A \tag{4.5}$$

where DEU_{ij} depends upon i through the random coefficients η_i. If the subject chooses option B, $Y_{ij} = 1$, and $Y_{ij} = 0$ otherwise. Then:

$$Y_{ij} = \mathbb{I}\{\Delta DEU_{ij} > \tau\varepsilon\} \tag{4.6}$$

If η_i is given, the choices are independent of each other, because of the independence assumption on ε_{ij}. If η_i is not given, however, this is no longer the case, since the same realization of η_i drives all choices of respondent i in one wave of the experiment.

We estimated the model with simulated maximum likelihood (SMLE), separately for the two waves of the experiment. For details on the experimental and estimation procedure we refer the reader to Appendix 4.5.

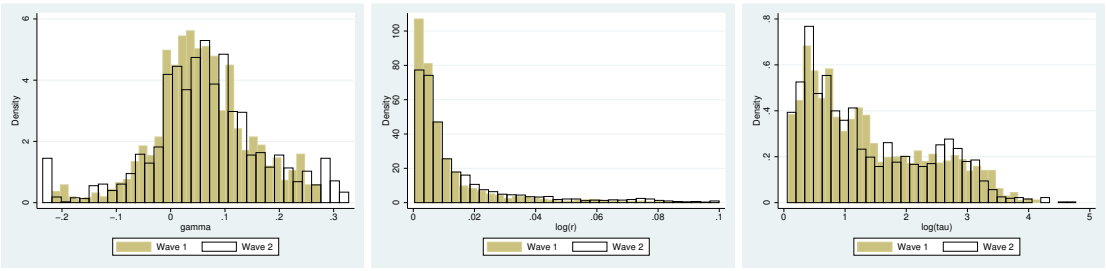
Once we have the estimates of the model parameters, we know the estimated distribution of the random coefficients η_i given X_i. Together with the individual's choices, this gives predictions of η_i at the individual level using Bayes rule: the (posterior) distribution of η_i given X_i and choices $y_i = \{Y_{ij}, j = 1, \ldots, J\}$ has density

$$P(\eta_i|y_i, X_i) = \frac{P(y_i|\eta, X_i)k(\eta, X_i)}{l(y_i, X_i)} \tag{4.7}$$

where $l(y_i, X_i)$ is the likelihood contribution of individual i, $k(\eta, X_i)$ is the density of the ((prior) multivariate normal distribution of η_i given X_i, and $P(y_i|\eta, X_i)$ is the probability of observing choice sequence y_i given η_i, X_i). We calculate the mean of these posterior distributions

for each respondent i; this gives the predicted vector of individual level parameters. [6]

In Figure 4.1 we show the sample distributions of the three predicted parameters for both waves. The figure suggests that the distributions in waves 1 and 2 are quite similar. A simple t-test comparing the means marginally reject the null that the mean risk aversion parameters are equal (p = 0.0187) and suggests that risk aversion in the second period is higher. On the other hand, there is no statistically significant difference between the means of the time preference parameter across waves.



(a) Risk aversion (b) Time preference (c) Tau parameter

Figure 4.1: Histograms

4.3.3 The data

In Table 4.8 and Table 4.9 in the Appendix we present the summary statistics for both waves, in total we have around 72% percent re-contact rate which is very high for these type of experiments (for example, Meier and Sprenger (2015) have a rate of around 28%). Around 320 people from our past sample were no longer LISS Panel participants, therefore, to compensate for the loss of observations, we sent invitations out to other participants. In total 2825 people are part of the first wave and 2224 people are part of the second wave. We will use this sample for the first two sections for our analysis at the individual level.

Apart from making use of all of our sample to analyze the stability of preferences, we will also construct a subsample in order to study the cross-spousal effect. For this purpose, we

[6] The same procedure to predict parameters at the individual level if followed by, among others, Von Gaudecker et al. (2011). An alternative would be to estimate a separate model for each individual, avoiding the distributional assumption on η_i. With a relatively small number of choices for each individual, however, this leads to inaccurate parameter estimates, many outliers, and convergence problems (with parameters converging to $-\infty$ or $+\infty$). Again, we did this separately for each wave, using the choices and model estimates for either wave 1 or wave 2. We therefore get separate predictions for each respondent in each wave.

aggregate the data at the household level and focus our attention specifically on couples[7]. To study the cross-spousal effect, we look at complete couples (we keep those observations in which both spouses in a household answered the survey) which are observed in both periods. The total number of couples we observe are 765. If we compare the summary statistics of the reduced sample of couples and the complete sample on Table 4.1, we observe that they do not significantly differ in their observed characteristics. The first two columns show the characteristics of the subsample (N=1530) and the last two columns the characteristics of the whole sample (N=2825), both of the first wave of the experiment.

Table 4.1: Summary statistics of reduced and complete sample, wave 1

	Reduced sample		**Complete sample**	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Age	54.8	14.4	52	14.9
Level of educ	3.624	1.442	3.686	1.464
High educ	0.329	0.468	0.345	0.476
Married	0.854	0.354	0.804	0.397
Number of kids	0.714	1.049	0.824	1.098
Self employed	0.048	0.213	0.055	0.227
Monthly gross income	1377	1825	1506	2029
Investments	0.128	0.332	0.140	0.347
Risk aversion	0.059	0.087	0.058	0.088
Time preference	0.076	0.285	0.081	0.297
Fechner error	1.389	0.988	1.392	0.984
Risk stated	3.140	2.228	3.221	2.294
Money patience	3.321	2.493	3.564	2.516
N	1530		2,825	

Notes: Means and standard deviations for the first wave of the experiment. The reduced sample consists of all complete couples and is used when analyzing preferences at the couple level; The complete sample consists of all individuals, including those whose partner did not participate in the experiment.

The variables which we consider to be possibly correlated with the variation of risk and time preferences across time are divided into three categories. The first one is the one related to satisfaction of personal finances, future expectations of their improvement or worsening and the general satisfaction with the economic situation of the country. The second category is related to their employment status, we looked closely at the composition and changes in the occupation

[7]We will only focus our attention on heterosexual couples since we do not have enough same-sex couples in our sample.

of individuals. This is of relevance for policy makers since we are interested in what can be the effect on preferences of general economic changes and personal impact of own and family employment changes. Last, we look at the level and changes of stated health status.

The following three questions were used to evaluate the first category:

1. How satisfied are you with your financial situation? from 0 (not at all) to 10 (entirely satisfied)

2. Can you indicate, from 0 to 10, whether your financial situation has gotten better or worse compared to one year ago? from 0 (much worse) to 10 (much better)

3. Do you expect your financial situation to get better or worse over the coming 12 months? from 1 (will get much better) to 5 (will get a lot worse)

4. How satisfied are you with the current economic situation in the Netherlands? 0 (not at all satisfied) to 10 (entirely satisfied)

In Table 4.2 we show the summary statistics for these variables including those of employment status and health. We observe that there are some very slight differences in the means between year 1 and year 2. The mean differences can be seen in column three along with their standard deviation in column four. Responses regarding satisfaction are expected to vary more often than those regarding employment since these are subjective valuations. Around 90% of our sample does not change employment status between our time periods.

Finally, the last factor we took into consideration when evaluating variation of preferences is the general health status of individuals. We obtain this information from a separate survey question which asks people to rate their overall health on a scale from 1 (poor) to 5 (excellent).

With this background information and the information from their choices in our experiment, we analyze in the following Section to what extent these preferences are stable between these two time periods and whether some individual or family shocks have any influence on them.

Table 4.2: Financial satisfaction and employment status

Variable	t_1	**Std. Dev.**	t_2	**Std. Dev.**	$t_1 - t_2$	**Std. Dev.**
Fin situation level	6.754	1.784	6.973	1.600	0.127	1.265
Fin situation change	5.270	1.501	5.477	1.393	0.230	1.544
Expectations future	3.131	0.771	3.086	0.678	-0.056	0.782
Satisfaction country	5.184	1.592	5.632	1.486	0.461	1.349
Paid employment	0.500	0.500	0.443	0.497	-0.024	0.254
Job seeker	0.036	0.187	0.032	0.176	-0.005	0.176
Work disability	0.036	0.186	0.037	0.188	0.000	0.097
Self employed	0.055	0.227	0.049	0.217	0.001	0.099
Pensioned	0.215	0.411	0.283	0.451	0.035	0.188
Housekeeping	0.102	0.302	0.106	0.308	0.000	0.128
Voluntary	0.017	0.129	0.015	0.121	-0.003	0.094
Health	3.067	0.726	3.068	0.730	-0.018	0.590

Notes: Means and standard deviations for the first wave (t_1), the second wave (t_2), and the change between waves ($t_1 - t_2$). Complete unbalanced samples for t_1 and t_2; complete balanced sample for $t_1 - t_2$.

4.4 Results

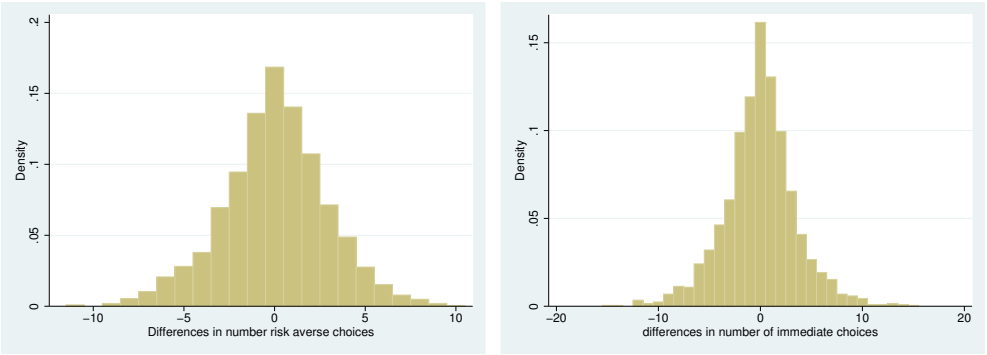
In this Section we present the results. In the first subsection we analyze the correlations between measures of risk aversion and discounting parameters in both waves, showing to what these measures are stable over these two time periods. We first analyze these correlations without controlling for individual characteristics and then control for some socioeconomic variables such as age and level of education. We also compare these correlations of the experimental measures with those based upon the stated preference survey questions. In the next subsection, we analyze at the individual level which type of shocks are related to changes of an individual's risk and time preferences. Finally, in the third subsection we present the results of the analysis at the level of couples, focusing on the effects of shocks affecting one spouse on the preferences of the other spouse. The first two subsections use the full sample to analyze stability of individual preferences. In the third subsection we use the smaller sample of complete couples to analyze the data at the couple level.

4.4.1 Stability of preferences

Before looking at the correlations of our structural model parameters, Figure 4.2 presents some information directly based upon the raw data: It shows the distribution of the differences in the

number of risk averse choices and the number of choices with earlier payment for the balanced sample of all respondents participating in both waves. The left hand panel shows substantial variation in the individuals' tendency to make risky choices in both directions: many respondents make fewer and many respondents make more risk averse choices in the second wave. The same applies to the right hand panel, with many respondents going from early to late payoff choices or the reverse.

On average people took 3.494 risk averse choices in the first wave and 3.560 in the second wave. The average number of earlier payment choices in the first wave is 10.116 and 10.069 in the second. Both differences are not statistically significant. The correlation coefficients between waves for the number of risk averse choices is 0.334 and 0.196 for the number of earlier payment. Without a structural model, a standard linear regression of the number of risk averse choices in the second wave explained by the number of risk averse choices in the first wave has an $R^2 = 0.1134$. I did not find any correlation between actual payment in the first wave and answers in the second wave.



(a) Risk aversion (b) Present choices

Figure 4.2: Differences in decisions

Using the estimates of the structural model introduced in Section 3.2, the raw data have been transformed into predictions of individual level parameters for risk aversion (γ_i), time preference ($\ln(r_i)$) and the tendency to make suboptimal choices ($\ln()\tau_i$)); see equation (7). This was done separately for the two waves. Table 4.3 shows the means and standard deviations of these parameter predictions along with the qualitative "stated preference" questions of risk aversion and time preference. The average risk aversion coefficient increased between waves (p= 0.003). For time preference and error propensity, the differences in means are not significant.

The correlation coefficients between waves are significantly positive: 0.253 for risk aver-

sion, 0.171 for the time preference parameters and 0.376 for the error propensity. In comparison, the existing literature, depending on the methodology and the study, finds correlations over time between -0.38 and 0.68 for risk aversion, and between 0.004 to 0.75 for time preference (Chuang and Schechter, 2015). For the stated preference questions, the correlation coefficients are larger: 0.573 for risk aversion and 0.650 for the stated time preference index. This is in line with the findings of (Chuang and Schechter, 2015). It could be interpreted as preferences measured qualitatively being more stable or less prone to measurement errors than the experimental ones (even though we accounted for the errors when computing the predictions).

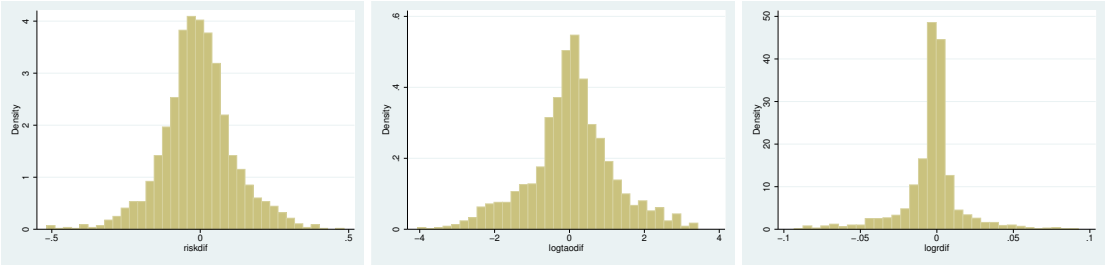
Table 4.3: Structural estimates and stated measures

Variable	**Mean t_1**	**Std. Dev.**	**Mean t_2**	**Std. Dev.**
Experimental measures				
Risk aversion	0.058	0.088	0.066	0.107
Time preference	0.081	0.297	0.067	0.240
Error parameter	1.392	0.984	1.360	0.999
Stated preferences				
Risk aversion	3.221	2.294	3.478	2.370
Money impatience	3.564	2.516	3.551	2.489
N	2825		2224	

Notes: Means and standard deviations for the first (t_1) and second (t_2) wave. Complete unbalanced panel.

To analyze whether the correlations between waves are due to observed or unobserved characteristics, we estimated random effects panel data models using the data from both waves and look at the contribution of the individual effects to the total unsystematic variation. The results are presented in Table 4.10 of the Appendix. As controls we include a wave dummy, dummies for females, age categories, and education, and the natural logarithm of individual net monthly income. We obtain the usual result that women are more risk averse on average than men and less prone to making mistakes (negative τ). Older respondents make more mistakes but do not have significantly different time or risk parameters compared to younger respondents. Higher education is associated with more patience and a smaller tendency to make suboptimal choices, as expected. The association between education and risk aversion is weak and only marginally significant. Fewer mistakes are made in the second wave than in the first wave, ceteris paribus, perhaps due to learning. Controlling for the socio-demographic variables we see that the values ρ are only slightly smaller than raw correlations mentioned previously. This shows that the explanatory variables do not contribute much to the stability of the three parameters over time. Only for the tendency to make suboptimal decisions the contribution of the explanatory variables is non-negligible, due to the important role of education.

In Figure 4.3 we depict the distributions of differences between both waves for the three predicted parameters. The histograms are centered at zero with symmetric variation around it. We observe that they both have approximately the same mean and therefore the difference is centered at zero. This suggests that on average preferences of individuals are stable between the two periods.



(a) Risk aversion (b) Tau parameter (log) (c) Time pref (log)

Figure 4.3: Difference wave 1 - wave 2

Another way of understanding how these measures are changing, is to look at how large the standard deviations of the individual posterior distributions are. For each person and preference, we calculated the standard deviation of the individual posterior distributions. Comparing the correlations between waves of those who have low and high standard deviations, we do not find significant differences.

A high error propensity (τ) diminishes the importance of other preferences (γ and r) in the risky lottery tasks. To exploit the information given by τ , we separate those cases where γ and r are not relevant. Splitting the sample according to the median of this variable, I compute the correlations between time periods of γ and r. The results show an improvement in the correlations of risk aversion measures between waves for those subjects with low τ which go from $\rho_\gamma = 0.25$ to $\rho_\gamma = 0.41$ (closer to the correlation of the stated parameters). The correlation between time preference parameters increases from $\rho_r = 0.17$ to $\rho_r = 0.19$. Intuitively, this was expected since the less likely individuals are to make mistakes in the valuation of the lotteries, the more likely their preferences determine choices in both waves.

For both waves, the correlation between risk aversion parameters of the lottery experiments and the risk aversion from the stated questions is around 0.20, while the correlation between our two time preference measures is insignificant. Therefore, the stated preferences indexes, even though they can be useful in explaining real life financial decisions of individuals (Falk et al.,

2015), do not correlate perfectly with the structural measures of risk aversion and discounting. Nevertheless, both measures capture risk taking attitudes towards real life financial decisions, such as investments in risky assets or level of financial wealth.

The correlations between stated and experimental procedures can be negatively affected by independent measurement errors in each of them. If we take the correlation of stated preferences as a benchmark (i.e., the maximum correlation that we can observe between responses of the same people at two different points in time to exactly the same question), we saw that these were lower than 1 (0.573 for risk aversion). Therefore, a correlation between experimental and stated measures of risk of 0.20 is high compared to a benchmark 0.573. Similarly, Falk et al. (2016) compute the correlation between two measurements from the same experiment and use this test-retest correlation as a benchmark correlation. They find that this test-retest correlation is substantially lower than 1 (0.3469 for risk taking, 0.6715 for discounting).

According to the literature on stability of preferences, we expected preferences to be stable over this short time period. Studies which used incentivized experiments have varied the timing of the experiments from 5-10 weeks (Wölbert and Riedl, 2013) up until 17 months Andersen et al. (2008). However, there are studies which point to short-term effects of sociodemographic variables Andersen et al. (2008) on measured preferences and other studies which find no evidence Meier and Sprenger (2015).

Another interesting observation is whether the associations between preferences and covariates are themselves stable over time. For example, associations with gender, age and education are consistent in the direction of the correlation between time periods. Women are more risk averse than men in both waves and older people are more likely to make mistakes.

4.4.2 Stability of preferences and individual shocks

Given that we observe a degree of variability in responses between years, we want to study whether individual shocks to employment, health or expectations lead to changes in preference measures towards risk and discounting. In particular, Andersen et al. (2008) find that the difference in risk attitudes can be explained partially by the personal financial state of the respondent. As explained in Section 4.3.3, we have similar information on the respondents' financial situation for a large part of our sample.

We estimated fixed effects models which include several controls describing the respon-

dents' financial situation: the stated satisfaction with the own financial situation, the expectation how this will change in the near future, and satisfaction with the economic situation of the country. Moreover, we include dummies for different types of occupational status: whether the person receives a pension, is a job seeker, takes care of the household, is self employed, has a work disability or performs voluntary work. The base category is paid work. See the data description in Section 4.3.3.

In Table 4.4 we show the results for the fixed effects model.[8] Since we have two periods, the fixed effects panel estimates are equivalent to OLS in (first) differences. The estimates show whether a change in any of the individual characteristics can explain a change in the elicited preference measure.

There are not many significant parameter estimates and they vary between experimental and stated measures. In the first column we can see that being an active job seeker as opposed to being employed, is associated with with a decrease in risk aversion. The change in net monthly income or the changes in subjective perceptions of the financial situation are not significant.

The tendency to make suboptimal choices in column two does not seem to vary with any of our explanatory variables. With respect to time preferences, we find that satisfaction with the economic situation of the country is positively associated with the discount rate. This means that as people become more satisfied with the economy, they also become more impatient. This could be explained by the fact that if people become less worried about the future they attach more value to their present consumption. Furthermore, taking up responsibilities as a homemaker is negatively correlated to the discount rate.

The last two columns of Table 4.4 show the coefficients for the regressions on stated risk and time attitudes. We find that an improvement in the financial situation is associated with a decrease in risk aversion and impatience. Health is also negatively related to impatience; an improvement in health is associated with an increase in patience. Finally, a transition from paid employment to doing voluntary work seems to have a negative impact on the stated measure of impatience. After performing a joint F-test of all the variables which are not significant, I cannot reject the H_0. This could be due to lack of small variation in the data. It would be necessary to expand the time frame between both waves to observe larger changes in these variables and possibly more significant effects. The overall model is significant after controlling for the level

[8] In the Appendix Table 4.11 we run the same regressions excluding health; since this variable has a lot of missing values, excluding it considerably increases the sample size. The qualitative results for the remaining variables stay the same as in our specification.

of τ.

We might expect that if risk and time preferences are correlated to each other, a shock that might affect one of them can also carry over to a change in another attitude. To allow for this possibility we estimated a SUR (seemingly unrelated regression) model in first differences where we allow the errors among the two preference equations and the propensity to make errors to be correlated with each other. This gives the same estimates for the slope coefficients as Table 4.4 but, in addition, gives an estimated correlation structure of the three error terms, shown in Table 4.12 of the Appendix. We observe that an (unsystematic) increase in impatience is associated with a(n unexpected) fall in risk aversion. Moreover, an increase in risk aversion and a decrease in impatience are both associated with a reduction of the tendency to make suboptimal decisions.

As mentioned before, the correlation between waves is stronger for those subjects who have low values of τ in both waves. To make our analysis more robust, we perform a median split according to the values of τ in our sample. Next, we regress risk aversion and discounting for these two separate samples. Results are presented in Table 4.5. We find a difference in the significance of the models themselves, as shown by the F-tests. The models belonging to those subjects with lower values of τ are significant, while those above the median are not. This is in line with the idea that if error propensity is too high, we cannot obtain accurate measures of preferences.

4.4.3 Stability of preferences and couple related externalities

Previous literature has found that preferences of spouses are positively correlated. As a consequence, something that changes the preferences of one spouse may also have an effect on the other spouse Bacon et al. (2014). In this section we analyze the effects of changes in the financial situation variables, occupational status, and health status of couples on each others' preference parameters.

In order to perform this analysis, we match each household member to their respective spouse[9] and obtain a total of 765 couples in which both partners are observed in both waves. We therefore construct a balanced panel with their respective individual and household level

[9]We talk about spouses in the text but we make no distinction between couples that have a marriage contract or a partnership agreement (living together). We ran different regressions with controls such as type of contract and found no difference between them.

Table 4.4: Fixed effects models: individual level

fe	(1) Risk aversion	(2) Error	(3) Impatience	(4) Risk stated	(5) Impatience stated
Log income	0.002	-0.048	0.006	-0.010	-0.103*
	(0.003)	(0.030)	(0.009)	(0.054)	(0.055)
Year	0.006*	-0.053	-0.013	-0.138**	0.112*
	(0.004)	(0.033)	(0.010)	(0.061)	(0.062)
Financial situation	-0.000	0.016	-0.002	-0.080*	-0.081*
	(0.003)	(0.026)	(0.008)	(0.048)	(0.049)
Expectations	-0.006	0.005	0.009	0.010	-0.013
	(0.004)	(0.040)	(0.013)	(0.074)	(0.075)
Country satisfaction	0.002	-0.028	0.022***	-0.025	0.007
	(0.003)	(0.025)	(0.008)	(0.046)	(0.047)
Health	-0.000	-0.034	-0.018	-0.011	-0.171*
	(0.006)	(0.054)	(0.017)	(0.098)	(0.100)
Number of kids	-0.013	0.094	-0.009	-0.078	0.107
	(0.012)	(0.116)	(0.036)	(0.212)	(0.216)
Job seeker	-0.042**	-0.084	0.016	0.027	-0.032
	(0.020)	(0.191)	(0.060)	(0.348)	(0.355)
Work disab	-0.046	-0.531	0.194	-0.280	-0.065
	(0.042)	(0.398)	(0.125)	(0.726)	(0.740)
Self employed	-0.009	-0.167	0.027	0.290	-0.091
	(0.041)	(0.385)	(0.121)	(0.703)	(0.716)
Pensioned	-0.002	-0.085	0.007	0.176	-0.295
	(0.019)	(0.182)	(0.057)	(0.333)	(0.339)
Housekeeping	0.021	-0.421	-0.221**	0.047	-0.290
	(0.031)	(0.294)	(0.093)	(0.538)	(0.548)
Voluntary	-0.013	0.068	-0.087	-0.455	1.857**
	(0.043)	(0.409)	(0.129)	(0.747)	(0.761)
Constant	0.059	1.968***	0.000	7.666***	5.056***
	(0.041)	(0.383)	(0.120)	(0.700)	(0.713)
Observations	2,658	2,658	2,658	2,658	2,658
R-squared	0.014	0.010	0.018	0.010	0.016
Number of nomem_encr	1,329	1,329	1,329	1,329	2,302

Notes: riskpost, riskstated: experimental and stated measures for risk aversion; logrpost, moneypat: experimental and stated measures for impatience; logtaopost: experimental measure for tendency to make suboptimal choices. Estimates use the complete balanced panel of all individuals. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

variables (i.e., number of kids living at home).

Table 4.6 shows the results of the fixed effects models of preferences with the spouse's and own covariates as explanatory variables. The main goal of these regressions is to see whether changes in any of these variables or shocks have a cross-spousal effect on an individual's preferences. These cross-spousal effects are the effects of the female's covariates on the man's preferences (covariates starting with p in columns (1) and (3)) and the effects of the male variables (not starting with p) on the women's preferences (columns (2) and (4)). Most cross-spouse vari-

Table 4.5: Fixed effects model: median split (according to τ)

FE	(1) Risk aversion	(2) Discounting	(3) Risk aversion	(4) Discounting
Log income	-0.003	0.010***	-0.001	0.006
	(0.004)	(0.003)	(0.004)	(0.019)
Year	0.013***	-0.007**	-0.001	0.002
	(0.004)	(0.003)	(0.005)	(0.022)
Financial situation	0.005	0.000	-0.003	-0.000
	(0.004)	(0.003)	(0.004)	(0.017)
Expectations	-0.001	0.002	-0.016**	0.038
	(0.005)	(0.004)	(0.007)	(0.030)
Country satisfaction	0.005	0.006**	0.006	0.023
	(0.004)	(0.003)	(0.004)	(0.016)
Health	-0.014**	-0.006	-0.002	-0.055
	(0.007)	(0.005)	(0.008)	(0.037)
Number of kids	-0.010	0.000	-0.047**	-0.001
	(0.015)	(0.012)	(0.020)	(0.087)
Job seeker	-0.061***	0.031**	-0.027	0.065
	(0.021)	(0.016)	(0.035)	(0.156)
Work disab	-0.026	0.164***	-0.149*	-0.408
	(0.052)	(0.039)	(0.079)	(0.351)
Self employed	-0.018	0.016	-0.038	0.096
	(0.049)	(0.037)	(0.055)	(0.245)
Pensioned	-0.034	0.000	-0.034	0.049
	(0.023)	(0.017)	(0.031)	(0.137)
Housekeep	-0.017	-0.207***	-0.091*	0.144
	(0.041)	(0.031)	(0.051)	(0.226)
Voluntary	-0.065	-0.077*	0.009	0.094
	(0.054)	(0.041)	(0.075)	(0.333)
Constant	0.117**	-0.056	0.125**	-0.013
	(0.052)	(0.040)	(0.056)	(0.249)
F-test	2.54***	11.93***	0.53	0.69
Observations	988	988	1,057	1,057
R-squared	0.083	0.283	0.043	0.020
Number of idnum	582	582	600	600

Notes: riskpost, riskstated: experimental and stated measures for risk aversion; logrpost, moneypat: experimental and stated measures for impatience. First two columns use observations of those individuals with τ below the median. Last two columns use observations of those individuals with τ above the median. *** p<0.01, ** p<0.05, * p<0.1.

ables do not appear to be significant, except for unemployment due to work disability of wives (related to risk and time preference of husbands) and financial satisfaction of husbands (related to error propensity of wives).

Perhaps surprisingly we find that it is the women's unemployment status which causes the cross-effects towards mens' attitudes. The effect of unemployment of women due to work

disability is correlated with an increase of risk aversion and impatience of their husbands. This could be a complementarity due to the fact that now that one spouse is out of the labour market, the couple has more time to consume in the present, and impatience increases. Another possible interpretation is that due to a negative household shock, spouses concentrate their efforts more on their present situation compared to those households that do not suffer such a shock (and can afford to be more forward looking).

We find no significant cross-spousal effects of men towards women except for the women's error propensity which is negatively correlated to the financial satisfaction of men.

4.5 Summary and Conclusions

In order to study the changes in elicited and stated risk and time preferences, we performed two experiments at two different points in time with a large representative sample of adult couples in the Netherlands. The experimental data were used to estimate, for each wave separately, a random coefficients model with individual level parameters of risk aversion (the curvature of the utility function) and time preference (a discount rate), as well as an individual specific tendency to make suboptimal decisions (the standard deviation of the Fechner error). We used the model estimates and the data to predict individual preferences and error tendencies. These three individual level predictions for the two waves were the basis for most of our further analysis.

We first analyzed whether choices in both experiments differed and found that there is variability in the raw choice data. However, the cross-section distribution of the three structural parameters hardly differs between the two. We found positive correlations of preferences between waves of around 0.253 for the risk aversion parameter, 0.171 for the time preference parameter and and 0.376 for the error propensity. These correlations are lower than those of stated preferences elicited using simple ordered response survey questions, which are 0.57 and 0.64 respectively. When we divide the sample according to the median value of the error propensity parameter, we observe that correlations of both, risk and time preferences, increase between waves. To be able to capture changes in preferences, it is essential for future research to consider the variability due to measurement error of the elicitation procedures.

The average risk aversion measured with the experiment increased slightly from the first wave to the second. One possibility might be related to with seasonality effects. The experiments took place in May and November. According Kamstra et al. (2017), people might be

Table 4.6: Fixed effects models: couple analysis

fe	(1) riskpost_	(2) priskpost_	(3) logtaopost_	(4) plogtaopost_	(5) logrpost_	(6) plogrpost_
year	0.006	0.004	-0.130**	-0.045	-0.016	-0.021
	(0.007)	(0.007)	(0.061)	(0.061)	(0.018)	(0.023)
loginc_	0.007	0.011	-0.036	-0.023	-0.014	-0.010
	(0.009)	(0.009)	(0.080)	(0.081)	(0.023)	(0.030)
health_	0.013	0.003	-0.026	-0.000	-0.036	0.000
	(0.010)	(0.010)	(0.094)	(0.094)	(0.027)	(0.035)
fin_sit_level_	-0.005	0.007	0.067	-0.107**	0.014	-0.011
	(0.005)	(0.005)	(0.048)	(0.048)	(0.014)	(0.018)
expectations_	-0.003	-0.002	-0.027	-0.027	-0.016	0.011
	(0.009)	(0.009)	(0.084)	(0.084)	(0.024)	(0.031)
satiscountry_	0.005	0.007	-0.048	0.025	0.015	0.024
	(0.005)	(0.005)	(0.044)	(0.044)	(0.013)	(0.017)
jobseeker_	-0.046	-0.008	0.136	-0.061	-0.071	-0.013
	(0.036)	(0.037)	(0.338)	(0.338)	(0.097)	(0.127)
selfemployed_	0.011	-0.003	-0.710	-0.735	0.035	0.006
	(0.075)	(0.076)	(0.696)	(0.698)	(0.200)	(0.261)
workdisab_	-0.041	-0.017	-0.428	-0.401	-0.247	0.024
	(0.068)	(0.069)	(0.631)	(0.632)	(0.181)	(0.237)
pensioned_	0.023	-0.014	-0.334	0.196	0.009	0.040
	(0.043)	(0.044)	(0.401)	(0.402)	(0.115)	(0.150)
housekeeping_	-0.010	-0.011	0.397	1.435	0.067	0.129
	(0.103)	(0.104)	(0.951)	(0.953)	(0.273)	(0.357)
voluntary	-0.019	0.063	-0.176	-0.479	0.031	-0.062
	(0.096)	(0.097)	(0.888)	(0.889)	(0.255)	(0.333)
ploginc_	0.000	0.003	0.030	-0.072*	0.006	0.026*
	(0.004)	(0.004)	(0.040)	(0.040)	(0.011)	(0.015)
phealth_	-0.014	-0.031***	0.047	0.160*	0.032	0.001
	(0.010)	(0.010)	(0.092)	(0.093)	(0.027)	(0.035)
pfin_sit_level_	-0.000	-0.000	0.006	0.039	0.005	0.005
	(0.005)	(0.005)	(0.048)	(0.048)	(0.014)	(0.018)
pexpectations_	-0.007	-0.015*	0.086	0.166**	0.014	0.017
	(0.009)	(0.009)	(0.083)	(0.083)	(0.024)	(0.031)
psatiscountry_	-0.004	0.000	-0.020	0.025	0.002	0.016
	(0.005)	(0.005)	(0.043)	(0.043)	(0.012)	(0.016)
pjobseeker_	0.056	-0.039	-0.254	-0.311	0.035	0.158
	(0.040)	(0.041)	(0.373)	(0.373)	(0.107)	(0.140)
pselfemployed_	-0.034	0.104	0.394	-0.791	0.028	0.148
	(0.089)	(0.089)	(0.819)	(0.821)	(0.235)	(0.308)
pworkdisab_	0.106*	-0.074	-1.115**	-0.435	0.403**	0.524**
	(0.059)	(0.059)	(0.544)	(0.545)	(0.156)	(0.204)
ppensioned_	0.006	-0.025	0.248	-0.012	0.060	0.008
	(0.030)	(0.031)	(0.282)	(0.282)	(0.081)	(0.106)
phousekeeping_	0.007	0.027	0.191	-0.641*	-0.034	-0.188
	(0.041)	(0.041)	(0.377)	(0.378)	(0.108)	(0.142)
pvoluntary	0.020	0.007	-0.204	-0.172	0.026	-0.096
	(0.056)	(0.056)	(0.514)	(0.515)	(0.147)	(0.193)
Constant	0.034	0.023	1.457	1.499	-0.063	-0.229
	(0.114)	(0.115)	(1.058)	(1.060)	(0.304)	(0.397)
Observations	888	888	888	888	888	888
R-squared	0.040	0.070	0.050	0.054	0.047	0.055
Number of nohouse_encr	444	444	444	444	444	444

Notes: riskpost, logrpost, logtaopost: experimental measures for risk aversion, impatience and the tendency to make suboptimal choices for men; Same *p-variables*: same experimental measures for women. Estimates use the balanced panel of complete couples. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

willing to take more risks in the spring and prefer safer investments in autumn. Their research is built upon studies on investment behavior in mutual funds, and is related to mood and environmental changes due to shorter days during autumn (which are strongly related to depression).

The changes in observed preference measures may be due to changes related to life events (e.g. health shocks or unemployment). To explore whether and how such events could explain variability in preferences, we estimated fixed effects models with the preference measures as dependent variables. We constructed three equations (for risk, time preferences and error propensity) for the parameters constructed from the incentivised experiment and two equations for stated preferences. The significant associations between changes in risk aversion are not the same as those which affect time preference, but also between measures based upon the experiment and stated preference measures based upon survey questions.

We found that having a higher level of satisfaction with the economic situation of the country is a significant predictor of a change in the discount rate. People who become more satisfied also get more impatient. This could reveal a precautionary savings motive; if people expect difficulties due to a worsening economy, they may be less inclined to prefer present consumption over savings. Our results in this respect might be sensitive to the timing of the survey waves, during the recovery of the economy after the 2008 financial and economic crisis.

We find that an improvement in health is associated with an increase in stated patience, which is in line with the literature on health habits and economic preferences. Health changes are not significantly associated with changes in the experimental measure of risk and time preference. Moreover, our stated and experimental measures of time preference are not significantly correlated to each other and therefore seem to capture different dimensions of discounting. The stated question is framed as impatience or impulsiveness with respect to spending, while the experimental variable is a discount rate of future income. Our finding thus implies that healthier people are less impulsive with respect to their spending, in line with literature that explores health outcomes in relation to economic preferences (Becker et al. (2012), Fuchs (1982), Falk et al. (2015)). We do not observe any cross-spousal effects with respect to changes in health status.

Understanding how employment affects risk and time preferences and, accordingly, economic decisions, can be an important factor when designing policies towards the unemployed population. For example, Pannenberg (2010) finds a negative correlation between subjects risk aversion and reservation wages. If reservation wages of risk averse individuals are lower, then

these individuals are less likely to be in long unemployment spells (Feinberg, 1977). Using the experimental measure of risk aversion, we found that respondents who lost their jobs and are actively looking for employment become less risk averse on average. According to job matching theories, these subjects, given their higher reservation wages, should last longer in an unemployment spell. The stated measure of risk taking did not seem to be affected by any changes in the employment status of the individuals (only weakly correlated to their financial situation).

People who become a homemaker tend to become less impatient. A person with a lower discount rate might be expected to work more and sacrifice current leisure in order to consume more in the future, but we see that the association goes in the opposite direction: becoming a homemaker leads to more forward looking behavior. The mechanism could be that becoming a homemaker reduces future income prospects, making people less eager to spend money in the present – they want to secure consumption in the future. It is worth noting that transitions into different types of non-employment have different effects; it matters whether non-employment is "voluntary" or due to a negative shock (such as work disability).

In summary, through the positive correlation between waves we observe a limited degree of stability of preferences. A higher correlation is observed in the stated questions, which is expected because these questions are less difficult and therefore less affected by idiosyncratic measurement errors. Nevertheless, we do observe that some individual shocks to labor or economic situation are significantly correlated to some of the variability in risk and time preferences. Also, we find that shocks to employment do have cross-couple effects, specifically for those losing their jobs because of work disability. We find that shocks affecting one member of the household (in this case a spouse) can have spill-over effects towards the behavior of another member. The stronger effect is on time preferences, where people with an adverse shock (or shock from their spouses) tend to discount the future more, focusing more on current utility.

Appendix

The lottery experiment consisted of four treatments in the gains domain with five choices in each treatment in the first wave and five treatments in the gains domain in the second wave. In each treatment each individual had to decide between two lotteries which varied in probability throughout the treatment but do not vary in payoffs. The lottery A had a lower variance than

lottery B and the expected payoff became larger as one proceeded down the list. Each screen contained five choices and pie charts illustrating the probabilities. Thus each subject has to choose in total 20 times in the first year and 25 times in the second year. These choices were used to estimate their preferences. We added five choices to wave 2 in order obtain more accurate estimates, this new treatment consisted of both choices delivering immediate payment.

The treatments differed in terms of the amounts in euros that could be earned, and in terms of the time periods in which these payments would take place. Table 4.7 shows the experimental design in more detail (the probabilities and quantities used to elicit preferences) of wave 1. This table also shows the expected value of each lottery and which choice a risk neutral individual would take. The subject chooses A or B in each row and one of these is at the end selected at random for actual payment. We told the subjects at the beginning of the experiment that they had a 1/10 probability of getting paid. The average payoffs were 13.4 euros with a standard deviation of approximately 7 euros.

In Figure 3.4 of Chapter 3 we present an example of a screen that subjects faced during one of the treatments, the same format and procedure was implemented in both waves.

We designed the choice lists with enough variation in its different dimensions such that we would be able to identify individual preferences. Before taking the experiment to the field, we ran simulations assuming a structural form of the utility function and parameters to ensure the identifiability of the preference parameters.

Table 4.7: Details of the experimental design

Treatment	p_A	$\$_{Ah}$	p_A	$\$_{Al}$	**EVA**	p_B	$\$_{Bh}$	p_B	$\$_{Bl}$	**EVB**	**EVA-EVB**
Timing		6 months					3 months				
I	0.15	11	0.85	9	9.3	0.15	23	0.85	0	3.45	5.85
	0.3	11	0.7	9	9.6	0.3	23	0.7	0	6.9	2.7
	0.5	11	0.5	9	10	0.5	23	0.5	0	11.5	-1.5
	0.85	11	0.15	9	10.7	0.85	23	0.15	0	19.55	-8.85
	1	11	0	9	11	1	23	0	0	23	-12
Timing		9 months					6 months				
II	0.15	15	0.85	10	10.75	0.15	29	0.85	4	7.75	3
	0.3	15	0.7	10	11.5	0.3	29	0.7	4	11.5	0
	0.5	15	0.5	10	12.5	0.5	29	0.5	4	16.5	-4
	0.85	15	0.15	10	14.25	0.85	29	0.15	4	25.25	-11
	1	15	0	10	15	1	29	0	4	29	-14
Timing		3 months					0 months				
III	0.15	20	0.85	15	15.75	0.15	25	0.85	2	5.45	10.3
	0.3	20	0.7	15	16.5	0.3	25	0.7	2	8.9	7.6
	0.5	20	0.5	15	17.5	0.5	25	0.5	2	13.5	4
	0.85	20	0.15	15	19.25	0.85	25	0.15	2	21.55	-2.3
	1	20	0	15	20	1	25	0	2	25	-5
Timing		3 months					6 months				
IV	0.15	12	0.85	7	7.75	0.15	22	0.85	0	3.3	4.45
	0.3	12	0.7	7	8.5	0.3	22	0.7	0	6.6	1.9
	0.5	12	0.5	7	9.5	0.5	22	0.5	0	11	-1.5
	0.85	12	0.15	7	11.25	0.85	22	0.15	0	18.7	-7.45
	1	12	0	7	12	1	22	0	0	22	-10

Notes: Each treatment consisted of five possible choices. $P_{A,B}$ are the probabilities of choice A,B with high and low payoff. EVA: Expected value of option A; EVB: Expected value of option B. The last column shows the difference between EVA and EVB.

Table 4.8: Summary statistics wave 1

Variable	Mean	Std. Dev.	Min.	Max.	N
Female	0.501	0.500	0	1	2,825
Age	52.041	14.935	18	91	2,825
Level of educ	3.686	1.464	1	6	2,825
High educ	0.345	0.476	0	1	2,825
Married	0.804	0.397	0	1	2,825
Number of kids	0.824	1.098	0	6	2,825
Civil servant	0.007	0.082	0	1	2,778
Self employed	0.055	0.227	0	1	2,825
Monthly gross income	2201.722	1918.725	0	53000	2,682
Investments	0.140	0.347	0	1	2,534
Financial wealth	17627.780	46364.560	-90000	700000	2,534
Total wealth	17671.430	76099.510	-940000	1300000	2,530
Risk stated	3.221	2.294	0	10	2,825
Money patience	3.564	2.516	0	10	2,825
Risk aversion exper	0.058	0.088	-0.218	0.276	2825
Time preference exper	0.081	0.297	0.000	2.330	2825
Error parameter exp	1.392	0.984	0.075	4.184	2825

Notes: Means and standard deviations for the first wave of the experiment.

Table 4.9: Summary statistics wave 2

Variable	Mean	Std. Dev.	Min.	Max.	N
Female	0.499	0.500	0	1	2,224
Age	55.674	14.413	20	93	2,224
Level of educ	3.667	1.476	1	6	2,224
High educ	0.352	0.478	0	1	2,224
Married	0.845	0.362	0	1	2,224
Number of kids	0.732	1.063	0	6	2,224
Civil servant	0.006	0.080	0	1	2,188
Self employed	0.049	0.217	0	1	2,224
Monthly gross income	2190.910	1601.783	0	13500	2,109
Investments	0.144	0.351	0	1	2,138
Financial wealth	18555.330	47948.200	-210936	700000	2,138
Total wealth	19061.140	85549.750	-940000	1300000	2,136
Risk stated	3.478	2.370	0	10	2,224
Money patience	3.551	2.489	0	10	2,224
Risk aversion exper	0.066	0.107	-0.235	0.328	2224
Time preference exper	0.067	0.240	0.000	2.668	2224
Error parameter exp	1.360	0.999	0.055	4.770	2224

Notes: Means and standard deviations for the first wave of the experiment.

Table 4.10: Random effects: individual level

	(1) riskpost_	(2) logtaopost_	(3) logrpost_
female_	0.027***	-0.101***	0.005
	(0.003)	(0.034)	(0.009)
Age: *25 -34*	-0.007	0.252**	0.016
	(0.013)	(0.125)	(0.035)
35 - 44	-0.003	0.303**	0.015
	(0.012)	(0.124)	(0.034)
45 - 54	-0.001	0.322***	0.023
	(0.012)	(0.124)	(0.034)
55 - 64	0.004	0.411***	0.047
	(0.012)	(0.123)	(0.034)
64 +	-0.000	0.635***	0.054
	(0.012)	(0.124)	(0.034)
loginc_	-0.000	-0.011	-0.003
	(0.001)	(0.008)	(0.002)
Education: *Intermed Voc Ed*	-0.003	-0.168***	-0.058***
	(0.004)	(0.041)	(0.011)
Higher Voc Ed	-0.007*	-0.356***	-0.084***
	(0.004)	(0.041)	(0.011)
University	-0.007	-0.517***	-0.092***
	(0.006)	(0.057)	(0.015)
year	0.006**	-0.070***	-0.013*
	(0.003)	(0.024)	(0.007)
Constant	0.042***	1.370***	0.121***
	(0.014)	(0.136)	(0.038)
rho	0.238	0.330	0.158
	0.021	0.020	0.024
Observations	4,791	4,791	4,791
Number of nomem_encr	2,873	2,873	2,873

Notes: riskpost: experimental measure for risk aversion; logrpost: experimental measures for impatience; logtaopost: experimental measure for tendency to make suboptimal choices. Estimates use the complete sample for which we have information on age, income and level of education. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 4.11: Fixed effects without health index: individual level

fe	(1) riskpost_	(2) logtaopost_	(3) logrpost_	(4) riskstated_	(5) moneypat_
loginc_	-0.001	-0.018	0.007	-0.017	-0.055
	(0.003)	(0.025)	(0.008)	(0.049)	(0.048)
year	0.006*	-0.043	-0.013	-0.221***	0.177***
	(0.003)	(0.030)	(0.009)	(0.057)	(0.056)
fin_sit_level_	-0.000	0.010	0.001	-0.046	-0.053
	(0.002)	(0.023)	(0.007)	(0.045)	(0.044)
expectations_	-0.003	0.010	0.010	0.045	0.027
	(0.004)	(0.035)	(0.011)	(0.068)	(0.067)
satiscountry_	0.002	-0.017	0.018***	-0.018	0.009
	(0.002)	(0.022)	(0.007)	(0.042)	(0.041)
numkids_	-0.014	0.030	-0.000	-0.133	0.181
	(0.011)	(0.100)	(0.031)	(0.194)	(0.189)
jobseeker_	-0.036**	-0.077	-0.000	0.122	-0.029
	(0.018)	(0.167)	(0.051)	(0.322)	(0.314)
workdisab_	-0.064	-0.396	0.174	-0.195	0.166
	(0.040)	(0.370)	(0.113)	(0.715)	(0.698)
selfemployed_	-0.012	0.251	-0.130	0.480	-0.273
	(0.032)	(0.302)	(0.092)	(0.584)	(0.570)
pensioned_	-0.004	-0.046	0.001	0.142	-0.335
	(0.017)	(0.163)	(0.050)	(0.315)	(0.307)
housekeeping_	0.013	-0.429*	-0.160**	-0.115	-0.186
	(0.027)	(0.253)	(0.077)	(0.489)	(0.478)
voluntary_	-0.023	0.125	-0.062	-0.260	1.361**
	(0.039)	(0.360)	(0.110)	(0.695)	(0.679)
Constant	0.076**	1.596***	-0.073	7.453***	3.778***
	(0.031)	(0.291)	(0.089)	(0.563)	(0.550)
Observations	3184	3184	3184	3184	3184
R-squared	0.011	0.006	0.014	0.014	0.013
Number of individuals	1592	1592	1592	1592	1592

Notes: riskpost, riskstated: experimental and stated measures for risk aversion; logrpost, moneypat: experimental and stated measures for impatience; logtaopost: experimental measure for tendency to make suboptimal choices. Estimates use the complete balanced panel of all individuals. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4.12: Seemingly unrelated regression: individual level

Correlations of residuals			
	ρ_γ	ρ_τ	ρ_r
ρ_γ	1		
ρ_τ	-0.715	1	
ρ_r	-0.188	0.133	1

Notes: Experimental measures of risk aversion (γ), time preference ($ln(r)$) and suboptimal decision making ($ln(\tau)$) resulting from SUR model.

Table 4.13: Fixed effects models: couple analysis

fe	(1) riskstated_	(2) priskstated_	(3) moneypat_	(4) pmoneypat_
year	0.429***	-0.044	0.232**	-0.018
	(0.112)	(0.115)	(0.112)	(0.116)
loginc_	0.074	0.213	0.210	0.142
	(0.148)	(0.151)	(0.147)	(0.153)
health_	0.053	0.041	0.253	-0.114
	(0.173)	(0.177)	(0.173)	(0.179)
fin_sit_level_	-0.052	-0.202**	-0.109	0.098
	(0.088)	(0.090)	(0.088)	(0.091)
expectations_	-0.043	-0.031	0.147	0.021
	(0.154)	(0.158)	(0.153)	(0.159)
satiscountry_	-0.091	0.052	-0.115	0.019
	(0.081)	(0.083)	(0.081)	(0.084)
jobseeker_	0.097	0.096	0.391	0.400
	(0.619)	(0.635)	(0.618)	(0.641)
selfemployed_	-0.455	-0.300	0.750	-0.745
	(1.277)	(1.309)	(1.275)	(1.322)
workdisab_	0.145	-0.646	0.666	-1.638
	(1.157)	(1.187)	(1.156)	(1.198)
pensioned_	0.561	0.086	0.478	0.110
	(0.735)	(0.754)	(0.734)	(0.761)
housekeeping_	3.058*	1.033	1.677	-0.037
	(1.745)	(1.789)	(1.743)	(1.806)
voluntary	1.955	1.328	5.866***	-0.859
	(1.628)	(1.669)	(1.626)	(1.685)
ploginc_	-0.020	-0.004	-0.076	-0.222***
	(0.073)	(0.075)	(0.073)	(0.076)
phealth_	-0.147	0.222	-0.268	-0.052
	(0.169)	(0.174)	(0.169)	(0.175)
pfin_sit_level_	0.015	0.107	-0.182**	0.020
	(0.088)	(0.090)	(0.088)	(0.091)
pexpectations_	0.314**	0.170	0.206	0.027
	(0.152)	(0.156)	(0.152)	(0.157)
psatiscountry_	0.114	0.165**	0.029	0.138*
	(0.079)	(0.081)	(0.079)	(0.082)
pjobseeker_	-0.144	0.361	0.272	0.195
	(0.683)	(0.701)	(0.683)	(0.707)
pselfemployed_	-0.212	0.305	-1.620	-0.802
	(1.503)	(1.541)	(1.501)	(1.555)
pworkdisab_	-0.368	0.788	1.771*	-0.353
	(0.998)	(1.024)	(0.997)	(1.033)
ppensioned_	-0.759	-0.255	0.031	-0.552
	(0.517)	(0.530)	(0.516)	(0.535)
phousekeeping_	0.077	-0.355	-0.895	-0.710
	(0.692)	(0.709)	(0.691)	(0.716)
pvoluntary	1.476	0.284	0.363	0.586
	(0.942)	(0.966)	(0.941)	(0.975)
Constant	2.161	-0.537	2.917	2.630
	(1.941)	(1.990)	(1.939)	(2.009)
Observations	888	888	888	888
R-squared	0.077	0.042	0.096	0.054
Number of nohouse_encr	444	444	444	444

Notes: riskstated, moneypat: stated measures for risk aversion and impatience for men. *P-variables*: same stated measures for women. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

5 | Does having a higher socioeconomic status pay off in reciprocal relations?

5.1 Introduction

Ethnic minority groups are often discriminated against in the labor market, housing market, or in different types of services. For instance, discrimination in the job market has been studied by Bertrand and Mullainathan (2004), who showed that for people with the same skills on a resume, call-back rates for African-American profiles were lower than those for white ones. Evidence of discrimination in the housing market, transport, or trade is presented by Ge et al. (2016), Edelman et al. (2015) and Hanson and Hawley (2011) who showed the existence of discrimination in sharing platforms such as Uber, Airbnb and Craigslist. They found that there was a tendency to infer from users' profiles (either names or pictures) whether they were African-American, and this lead to a higher rate of cancellations and rejections of their services. In a more recent study, Cettolin and Suetens (2016) found that Dutch natives reciprocate trust of a non-native trustor less frequently than that of a native trustor, suggesting discrimination.

Ethnicity has been found to be correlated to the socioeconomic status (SES) of an individual or group (Fryer and Levitt, 2004; Williams, 1999).[1] SES refers to the ranking of an individual or group in a given society (Weiss and Fershtman, 1998). A recent study has found that SES is a powerful predictor of many facets of a child's economic preferences and IQ, which could lead to social immobility (Deckers et al., 2015). It is difficult to infer from the above-mentioned

[1]For instance, Fryer and Levitt show that first names signal socioeconomic status amongst Blacks born after the 1970's.

papers on ethnic discrimination whether ethnicity or SES is the source of the discrimination. In this paper we solve the identification problem by focusing solely on role of SES, ruling out the scope for ethnic discrimination.

We study whether people exhibit different levels of trust or reciprocity depending on the level of SES of their counterparts. We focus our attention on a sample of native Dutch individuals. Trust and trustworthiness are components of social capital (Falk and Zehnder, 2013; Loury, 1977; James S, 1990; Putnam, 2000), which in turn is related to economic success. Societies with high levels of trust have to spend less resources on ensuring their economic transactions or protecting their property. It has also been shown that societies with low levels of social capital receive lower returns to education and thus potentially discourage innovation (Arrow, 1972; Knack and Keefer, 1997).

We use data of a trust game experiment performed on the LISS panel by Cettolin and Suetens (2016). The LISS Panel is an ongoing panel covering the adult Dutch population, including those without internet (Scherpenzeel, 2011).[2] The main feature of the experiment was the revelation of the first names of participants to their counterparts. Hence, trustors as well as trustees were aware of the name of the person with whom they were matched. We elicited perceived SES related to the first names from a sample which was also drawn from the LISS panel but did not include participants of the experiment. We asked participants to rate a list of names on a five-point scale, from low SES to high SES. With these ratings, we constructed an index per name by computing the average SES given to each name. Even though SES is a subjective measure inferred by names, the index turns out to be correlated with observed background characteristics which are considered important for defining status (e.g., level of education and income). We analyze whether the SES of the matched participant or differences in SES between them are relevant for explaining the decision to trust or to reciprocate.

We find that the choice to trust or reciprocate is not influenced by the SES of the matched participant. However, we find an effect of the participants' own level of SES as well as the distance in SES between players on the reciprocation rate. That is, trustees with a high SES, or trustees whose SES is very different from that of the matched trustor, tend to reciprocate more often. We find no such effects on trust decisions.

Our research is related to the literature which studies the effects of SES on economic behavior. One of the first experimental studies with variation in status by Ball and Eckel (1998),

[2] See https://www.lissdata.nl/lissdata/.

shows that higher status individuals earn more in economic experiments. Consequently, other studies have examined different mechanisms through which status has an effect on economic outcomes. For example, Eckel and Wilson (2007) and Ball et al. (2001) show higher coordination rates in an experiment when agents have a high status. Moreover, participants with high status earn higher payoffs in a market setting (even when this higher status is randomly assigned). These findings show that individuals (and groups) attach large importance to these status rankings even when these differences are artificially assigned. Another experiment carried out outside the laboratory is, for example, Falk and Zehnder (2013) who study whether socioeconomic status can explain why people discriminate in a trust game. They find that people participating in a trust game could predict well the trustworthiness of participants living in high SES areas. Subjects had knowledge of the neighborhood of residence of participants and could infer SES correctly.

The rest of the paper is organized as follows. In Section 5.2, we present the design of the trust game and the SES elicitation method along with the data description. Section 5.3 presents the results of our analysis on trust and reciprocity. Finally, Section 5.4 summarizes and concludes.

5.2 The trust game and SES: The data

The trust game

Trust and trustworthiness are related to each other but describe the behavior of two different roles in a given transaction. Trust is exercised by an agent who decides to, for example, transfer money to another with some expectations of future returns. This decision has some inherent risk of potential losses due to the possible defection of the receiving agent. Trustworthiness describes the behavior of the recipient who decides whether to reciprocate; by doing so, increasing the returns of the trustor.

We use data elicited by Cettolin and Suetens (2016) from a trust game experiment. To separate possible effects of ethnicity from socioeconomic status, we focus on those treatments where natives are matched to other natives. We are able to do this since there is enough variation in the SES of the native participants to be able to identify a possible effect.

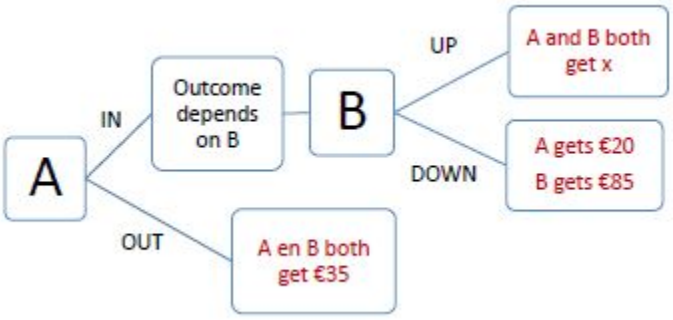


Figure 5.1: Decision tree

Note: Figure 1 taken from Suetens and Cettolin (2016) which displays the format shown to the participants of the experiment.

The structure of the trust game is described as follows[3]. Trustors had to choose between IN and OUT in the three binary trust games where the payoff for OUT was (35,35) in each of these three treatments. If IN was chosen, the payoff depended on what the trustee chose as an action. The trustees played three binary trust games where the payoffs from reciprocating are described by vector $x = [(40,40),(60,60),(80,80)]'$. If the trustee defected and decided not to reciprocate, the payoffs were (20,85) in each of the three treatments. Trustees had to decide their strategy for each game independent of the actions of the trustor. In the final phase of the experiment, subjects were matched and payments were realized and distributed to their LISS accounts. Figure 5.1 shows the structure of the game as a decision tree. In the experiment, subjects had expected earnings between €12 and €21.75 per hour. The approximate duration of the experiment was ten minutes. The participants additionally received a participation fee of €1.50.

Table 5.1 shows descriptive statistics for trustors and trustees separately. Both groups are similar in their background characteristics which is as expected given that the roles were randomly allocated. We also show the summary statistics of their trust and reciprocity decisions for each game, t_j and v_j, with $j = 1,2,3$. We observe differences in the trust and reciprocation rate depending on the size of the gains from mutual cooperation. For example, if the gains from cooperation were highest, around 61.7% decided to trust and 65.3% to reciprocate, while if they were lowest 45.1% and 58.9% trusted and reciprocated respectively. The difference between

[3]The instructions to the trust experiment as shown to participants, are included in the Appendix.

cooperation in low versus high mutual gains are highly significant for trust decisions (*t-test*, $p < 0.01$) and weakly significant for reciprocity ones (*t-test*, $p = 0.0501$).

Table 5.1: Descriptive statistics of participants of the trust game

Variable	N	Mean	Std. Dev.	Min	Max
		Trustors			
Male	326	51%			
Age	326	50.620	17.208	16	87
Number of kids	326	0.776	1.105	0	6
Monthly gross income	315	2212.934	1528.407	0	10000
Education level	325	3.846	1.451	1	6
Self employed	326	0.028	0.164	0	1
Pensioned	326	0.242	0.429	0	1
Trust					
t1	326	0.451	0.498	0	1
t2	326	0.515	0.501	0	1
t3	326	0.617	0.487	0	1
		Trustees			
Male	329	49%			
Age	329	52.033	17.209	17	88
Number of kids	329	0.641	0.956	0	4
Monthly gross income	306	2314.822	1710.182	0	12674
Education level	329	3.605	1.535	1	6
Self employed	329	0.049	0.215	0	1
Pensioned	329	0.243	0.430	0	1
Reciprocity					
v1	329	0.593	0.492	0	1
v2	329	0.617	0.487	0	1
v3	329	0.653	0.477	0	1

Notes: The first panel shows descriptive statistics of the first player (player A/trustor), including mean and standard deviation of their decisions to trust in each game. The second panel shows descriptive statistics of the second player (player B/trustee), including mean and standard deviation of their decisions to reciprocate in each game.

The game was elicited using the strategy method which is particularly suitable for situations in which subjects cannot play a game in real time (Selten, 1967; Mitzkewitz and Nagel, 1993; Brandts and Charness, 2011). Matching of A and B players, was done by the experimenter ahead of time. Hence, the names of each pair were common knowledge for both parties. This is ensured for every pair. Given that this was an Internet experiment, subjects did not have direct contact with each other.

The experiment was carried out in the LISS panel (Longitudinal Internet Studies for the

Social sciences) administered by CentERdata (Tilburg University, The Netherlands). The total sample for the trust experiment consisted of 691 trustees, from which 329 trustees were matched to native trustors. The elicitation was carried out in two separate waves. The first wave when trustees had to submit their choices in December 2014, and the second wave in March 2015 when matched trustors had to submit their choices. Both names were common knowledge for both trustors and trustees.

Socioeconomic status

Socioeconomic status refers to the relative rank or position of an individual or group in society. The literature on the measurement of SES refers to a variety of determinants which can be measured objectively or through self-reported assessments. The determinants of SES which can be measured objectively, can range from characteristics such as the level of education, wealth and occupation prestige, to the family characteristics, i.e., parents' level of education (Fryer and Levitt, 2004; Glaeser et al., 2000; Trautmann et al., 2013; Piff et al., 2012). A popular subjective measure in the psychology literature, is given by the self-reported position on a ladder which represents where people stand in society (Adler et al., 2000).

In this study, we elicit perceptions of SES according to names. To elicit perceptions, we defined SES as: the ranking or position that individuals have in a given society.[4]

We designed a survey questionnaire in which we asked participants to rate the perceived SES of a list of first names. The scale consisted of the following status levels:

1. *Low status*
2. *Middle-low status*
3. *Middle status*
4. *Middle-high status*
5. *High status*

[4]We follow the definition of Weiss and Fershtman (1998)

In total, we created 15 mutually exclusive lists of 52-55 names each. Each person worked on one list only. Participants were compensated according to an hourly rate set by LISS panel for the participation in regular surveys. The hourly rate was 15 euro and participants in the median duration of the experiment was around 4 minutes, which translates into a participation payoff of €1. More details and explicit instructions as used in the survey questionnaire translated to English are included in the Appendix.

We calculated the perceived SES indices based on the mean of the scores assigned by individuals to each name. The average number of ratings per name was 29 with a standard deviation of approximately 6 (see Table 5.2). As mentioned in the previous section, first names are assumed to reflect socioeconomic characteristics of an individual. Therefore, to test this assumption, we first tested the hypothesis that these average ratings are correlated to background characteristics which the literature has shown to be associated to SES, such as income or level of education. For this purpose, we matched SES to the names of the participants of the trust game and studied the relationship between SES, trust and reciprocity. Allowing for an external group (to the experimental trust game) to rate perceived SES can mitigate the problem of self-assessment bias which would be introduced if we asked subjects who participate in the trust game to rate themselves.

The survey was also carried out in the LISS panel. We selected 572 household members to participate in the survey and had a 76.9% response rate. In total 440 people participated and 4 people out of this sample did not complete the whole questionnaire. We have information on the background characteristics of those individuals who are rating the names. Table 5.8 in the Appendix, shows these characteristics.

Figure 5.2 shows the distribution of the indices of perceived SES. The average SES level was 3.183 with standard deviation of 0.272. To check whether the scale is internally consistent, i.e. the items are capturing the same dimensions through our scale, we calculated Cronbach's alpha (Cronbach, 1951) for each list of names. We find that our scale is highly internally consistent with an average alpha across the lists of 0.805 for the 15 lists and 440 raters in total. A summary of the main characteristics of our elicitation results is shown in Table 5.2.

An example of the types of names and their index of perceived SES is shown in Figure 5.6 in the Appendix. Here, names are ordered on the horizontal axis according to their perceived SES index. The vertical axis shows the size of the standard deviation corresponding to each name. Names with lower standard deviation in their ratings reveal more agreement; later we

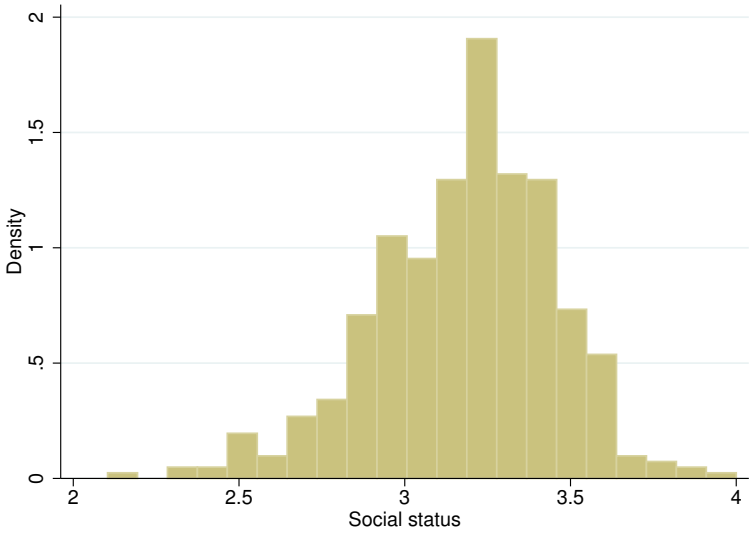


Figure 5.2: Distribution of perceived SES ratings

Table 5.2: Descriptive statistics on percieved SES ratings

	Mean	Std.	Min	Max	Obs
SES ratings	3.183	0.272	2.103	4	453
Raters per name	29.333	5.614	20	40	440
	Average Cronbach alpha				0.805
	Groups total				15

Notes: The column Obs denotes the observations of the number of names rated in the first row, and the number of people who rated a list in the second row. Average Cronbach alpha is calculated as the average alpha across 15 lists. The individual values of alpha for each list do not vary from this value much.

will use these values to check for the sensitivity of our results.

Once we assigned an index to the each name, we analyzed whether these ratings are correlated to observed characteristics related to SES of individuals. We looked at characteristics for which we have information available in the panel. Namely, we have information on gender, age, income and level of education. Other background characteristics we include have been used in the literature (e.g., see Trautmann et al., 2013) to classify people into different levels of SES are: the type of job, whether they have supervisory roles and what type of contract they have (permanent or temporary)[5].

[5]Questions regarding employment of those subjects who are retired, refer to their last employment.

We performed OLS regressions on the index of SES allowing for the errors of names belonging to the same group to be correlated (i.e. groups of people with the same name). In Table 5.3 we show the results of four linear regression specifications of the index of SES as the dependent variable. We include gender and age categories of ten years each as controls and we take the age group 16-24 as the base category. The first specification includes three levels of education with primary and secondary education as base category. Since we do not have complete information on income and occupation of all participants, we add a separate specification (2) where we show the results of including these variables in the model. In columns three and four, we analyzed the relationship between their occupational characteristics and their SES independently.

People with university education on average have higher status rankings compared to those who only have primary or secondary education and occupation. Income shows a positive coefficient which is weakly significant due to collinearity with level of education. We found a gender effect in SES, i.e., females are significantly lower rated in terms of SES. The results also show a negative relationship between age and SES, with a stronger effect for the higher age categories[6]. Miyakawa et al. (2012), found that subjective social status is negatively correlated to age and health status, which might reflect their position in society. In columns 3 and 4, we find a positive correlation between having a permanent contract and SES. Also, having a supervisory role is weakly correlated to higher SES, even if we control for the level of education (not shown in the Table)[7].

5.3 Results

In this section we analyze the effect of SES of the matched player and the effects of differences in SES on choices regarding trust and trustworthiness. We first show the reciprocation decision and after that the results of the trustors. Throughout this section we will denote the trustor as player A and the trustee as player B.

The channels which we consider through which SES can have an effect on the decision to

[6]Figure 5.7 shows the distribution of SES split by age categories. We observe that there is less variation in low age categories than in the older groups.

[7]Another index we used to control for *own* SES in the next section is constructed from the observed characteristics of the individuals participating in the trust game (following Trautmann et al. (2013) and Piff et al. (2012)) In the Appendix, show the details of this index. The correlation between between this “objective" index of one’s SES and perceived SES elicited on the basis of the name is $\rho = 0.132$ ($p<0.01$).

Table 5.3: Results of regressions of SES on individual characteristics

	(1)	(2)	(3)	(4)
Male	0.085***	0.079**		
	(0.032)	(0.031)		
Age				
25-34	-0.077***	-0.104***		
	(0.028)	(0.031)		
35-44	-0.087***	-0.126***		
	(0.029)	(0.032)		
45-54	-0.167***	-0.205***		
	(0.033)	(0.035)		
55-64	-0.201***	-0.233***		
	(0.034)	(0.037)		
>65	-0.240***	-0.256***		
	(0.037)	(0.038)		
Education level				
Intermed Voc Ed	0.018	0.013		
	(0.020)	(0.021)		
Higher Voc Ed	0.030	0.026		
	(0.021)	(0.024)		
University	0.081***	0.073**		
	(0.026)	(0.029)		
Permanent contract		0.018	0.042**	0.037*
		(0.020)	(0.020)	(0.022)
High job type		0.005	0.007	0.014
		(0.018)	(0.016)	(0.016)
Supervisor		0.017	0.043*	0.044*
		(0.022)	(0.026)	(0.026)
Log(income)		0.006		0.000
		(0.004)		(0.006)
Constant	3.255***	3.231***	3.132***	3.126***
	(0.026)	(0.032)	(0.021)	(0.037)
Observations	1,018	973	1,020	974
r2_a	0.115	0.115	0.0120	0.0104

Notes: OLS regression on the mean index of SES. Income is denoted as the logarithm of monthly gross income. The omitted category of age contains ages which range from 16-24. The omitted category of education is primary and high school (lower secondary education). Clustered standard errors in parenthesis at the name group level. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

reciprocate are the level of SES of the matched player or the differences between players' SES. To test whether the differences in SES according to their names can explain heterogeneity in

reciprocation, we specify three explanatory variables defined as follows:

$$SES^A \tag{5.1}$$

$$Dif_{SES} = SES^B - SES^A \tag{5.2}$$

$$Absdif_{SES} = |SES^B - SES^A| \tag{5.3}$$

where Dif_{SES} denotes the differences allowing for positive or negative differences depending on whether player B's SES is higher or lower than that of A. $Absdif_{SES}$ shows the absolute value of the difference in status between A player and B player and therefore, a measure of the distance between them.

To explore this relationship, we constructed a random effects model of reciprocation. We defined the outcome of the decision to reciprocate as a binary variable $V_{it} = \{0,1\}$. Also, we defined v^*_{it} as the trustee's unobservable latent propensity to reciprocate. The index i denotes individual specific characteristics and the status of the person they are matched with and t denotes the game:

$$\begin{aligned} v^*_{it} &= SES^A_{it}\delta_1 + Male^A_i\delta_2 + \mathbf{X'_{it}}\beta + \mathbf{payoff'_{it}}\gamma + \alpha_i + \varepsilon_{it} \\ v^*_{it} &> 0 \quad if \quad V_{it} = 1 \\ v^*_{it} &\leq 0 \quad if \quad V_{it} = 0 \end{aligned} \tag{5.4}$$

where α_i is the individual specific effect which is constant over time. We assume α_i is i.i.d. and follows a normal distribution with mean zero and variance σ^2_α. The variable SES^A_i denotes the socioeconomic status of the trustor, or in separate specifications, the differences in SES. $Male^A_i$ is a dummy for player A's gender.[8] Observed characteristics of the trustee are denoted by the vector X_i. These characteristics include trustee's age, level of education, gender and logarithm of monthly gross income. In a separate specification we also included her own level of SES (SES^B_i). The three games correspond to the different level of payoffs and are controlled for in vector $\mathbf{payoff'}_{it}$, where the first game is the omitted category.

Results are shown in the first two columns of Table 5.4. The first three columns of the panel corresponds to including different definitions of SES as defined above. The last two columns

[8] We decide to include gender explicitly to look at the effect of SES keeping this variable constant.

of the panel corresponds to the same specifications and additionally adding own SES^B of the player making the choice to reciprocate. In the first specification we do not find any significant explanatory variables. In the second, we find that differences in SES positively correlate with the propensity to reciprocate. This means that if player's B status increases relative to that of A, the more likely she will reciprocate. The coefficient of the third model specifying the absolute difference or distance between SES^A and SES^B is also positive and significant. For instance, calculating the marginal effects, we find that if the distance increases by 1 point, the likelihood of reciprocating increases by around 16%.

The results of including the own SES of player B are included in the last two columns of Table 5.4. We find that own SES is significant in predicting the propensity to reciprocate. These results hold even when controlling for variables which are correlated to SES^B. Model (5) shows that the absolute distance also increases the propensity to send back a high amount, keeping SES^B constant.[9] To compare models (4) and (5), and given that they are non-nested, we performed a Vuong test which compares the likelihood contributions of both models (Vuong, 1989). We cannot reject the null hypothesis that both specifications are equivalent (p = 0.117).

In the Appendix, Table 5.11, we show the results of constraining the sample to those names that have low standard deviations in their individual ratings[10]. Results do not change significantly, except for Model (3) in which the absolute difference is no longer significant.

Next, instead of using the subjective SES elicited by the names, we use an *objective* index based on observed characteristics (refer to the Appendix for details on the construction of this index). In the Appendix, on Table 5.6, we show the results of using the *objective* SES of player B and the subjective SES of player A as explanatory variables of the reciprocity decision. Here, we do not find any effect of the differences in SES of players; also not of their own *objective* SES (in line with the findings of Trautmann et al.). These results may imply that perceived SES on the basis of names captures dimensions of SES that our objective index does not capture.

[9]The variation captured by the unobserved heterogeneity random effects model is $\rho = 0.227$. With respect to the effects of the observed characteristics, in a separate model, we interacted age with the indicator of each game since the gains from cooperation increased in each of them. According to Bellemare and Kröger (2007) in an investment game, age and the size of returns by the second player exhibit a U-shaped relationship. We find different effects of age on reciprocity which depended on the size of the gains from cooperation. Studies like Dohmen et al. (2008) and Falk et al. (2015) have found a positive relationship between positive reciprocity and age, or an inverted U-shape relationship. However, these measures are substantially different from the trust game since they are based on survey questions. We also analyzed each game separately without including random effects and we found similar results for the game with the highest payoffs. See Table 5.9 in the Appendix.

[10]We split the sample by the median of standard deviations.

Table 5.4: Probit regression on reciprocity decisions

	(1)	(2)	(3)	(4)	(5)
SES^A	-0.194			-0.191	
	(0.223)			(0.222)	
Dif_{SES}		0.318**			
		(0.161)			
$Absdif_{SES}$			0.511**		0.623**
			(0.253)		(0.258)
$Male^A$	-0.157	-0.146	-0.172	-0.149	-0.164
	(0.112)	(0.111)	(0.111)	(0.112)	(0.110)
Payoff medium	0.072	0.072	0.072	0.072	0.073
	(0.109)	(0.109)	(0.109)	(0.109)	(0.109)
Payoff high	0.178	0.179	0.177	0.178	0.177
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)
SES^B				0.455*	0.562**
				(0.232)	(0.237)
Constant	0.848	0.228	0.113	-0.606	-1.703**
	(0.741)	(0.243)	(0.251)	(1.044)	(0.805)
Observations	918	918	918	918	918
Number of id	306	306	306	306	306
rho	0.227	0.222	0.221	0.222	0.213
ll	-586.8	-585.2	-585.1	-584.8	-582.2

Dependent variable: reciprocity in 3 games. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age, gender, income and level of education of the trustee, none of which are significant at the 10% level.

Think, for example, of culturally related dimensions that are uncorrelated with income.

Similarly, we analyze A's decisions to trust player B with a random effects model. We include as explanatory variables three different specifications of SES. First, we include the level of SES of player B (the matched player). Second, we introduce the differences in SES between player A and B. Third, we introduce the absolute differences:

$$SES^B \tag{5.5}$$

$$Dif_{SES} = SES^A - SES^B \tag{5.6}$$

$$Absdif_{SES} = |SES^A - SES^B| \tag{5.7}$$

According to the literature, some of the motivations which may drive the decision to trust can range from the belief of player's B trustworthiness to individual risk aversion (Schechter, 2007; Sapienza et al., 2013). Schechter shows that not controlling for risk aversion when re-

gressing trust, can significantly bias other estimates. Risk taking attitudes were obtained with a qualitative survey question regarding their willingness to take risks which is standard in the literature[11]. Let us define the dependent variable as the decision to trust in each game T_{it} and variable t_{it} to denote the trustor's unobservable latent propensity to trust in the following way:

$$t^*_{it} = SES^B_{it}\delta_1 + Male^B_i\delta_2 + \mathbf{X'_{it}}\beta + riskav^A_{it} + \mathbf{payoff'_{it}}\gamma + \alpha_i + \varepsilon_{it} \quad (5.8)$$

$$t^*_{it} > 0 \quad if \quad T_{it} = 1 \quad (5.9)$$

$$t^*_{it} \leq 0 \quad if \quad T_{it} = 0$$

where α_i is the individual specific parameter constant over time. We assume α_i is i.i.d. and follows a normal distribution with mean zero and variance σ^2_α. The variable SES^B_i denotes the SES of the trustee or in separate specifications, the differences in SES. $Male^B_i$ is a dummy representing the trustee's gender. Observed characteristics of the trustor are denoted by the vector X_i. These characteristics include trustor's age, level of education, gender, and logarithm of monthly gross income. In a separate specification we also included her own level of SES (SES^A_i). The three games correspond to the different levels of payoffs, which are controlled for in vector **payoff'**$_{it}$.

Results are shown in Table 5.5. SES levels of the trustor or trustee and their differences are not significantly correlated to the decision to trust. The effect of the higher payoffs are positively correlated to a higher likelihood of trusting behavior. Another significant variable is risk aversion; the less willing a person is to take risks the less likely she will choose to trust.[12] In the Appendix, Table 5.12, we show the results of constraining the sample to those names that have low standard deviations in their individual ratings[13]. When we restrict the sample to those names with low standard deviations, the absolute difference in SES is weakly significant.

If we estimate a probit for each game separately, we find that additionally in the high payoff game, own level of status (player A) is positively correlated to the propensity to trust ($p =$

[11] See, for example, Dohmen et al. (2011); Charness et al. (2013); Falk et al. (2016)

[12] This is in line with what previous research has found, such as (Schechter, 2007; Sapienza et al., 2013). Other studies have failed to find a relationship between trust and risk aversion. For instance Houser et al. (2010), Eckel and Wilson (2004) and Fairley et al. (2016) do not find a relationship between risk elicited experimentally through an investment game or a lottery game. Fairley et al. do find a relationship between trust and risk if the uncertainty comes from a social component rather than a lottery. Therefore, this relationship is sensitive to the way in which risk aversion is elicited.

[13] We split the sample by the median.

0.062).[14]

Table 5.5: Probit regressions on trust decisions

	(1) t	(2) t	(3) t	(4) t	(5) t
SES^B	-0.118			-0.120	
	(0.226)			(0.226)	
Dif_{SES}		0.136			
		(0.166)			
$Absdif_{SES}$			0.177		0.188
			(0.267)		(0.267)
$Male^B$	0.000	0.001	-0.012	-0.001	-0.013
	(0.115)	(0.114)	(0.113)	(0.115)	(0.113)
Payoff medium	0.168	0.168	0.168	0.168	0.168
	(0.117)	(0.117)	(0.117)	(0.117)	(0.117)
Payoff high	0.499***	0.499***	0.499***	0.499***	0.499***
	(0.120)	(0.120)	(0.120)	(0.120)	(0.120)
Risk averse	-0.062**	-0.062**	-0.063**	-0.062**	-0.062**
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
SES^A				0.156	0.165
				(0.242)	(0.242)
Constant	0.544	0.162	0.129	0.047	-0.405
	(0.757)	(0.278)	(0.287)	(1.080)	(0.835)
Observations	741	741	741	741	741
Number of id	247	247	247	247	247
rho	0.144	0.143	0.143	0.143	0.142
ll	-493.1	-492.9	-493.0	-492.9	-492.8

Dependent variable: trust in 3 games. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age gender, income and level of education, none of which are significant at the 10% level.

As in our previous analysis of reciprocity decisions, the trustor in this case has better knowledge of her own SES. Therefore, we use an *objective* SES measure to compare the differences in SES. Table 5.7 in the Appendix, shows the results for similar regressions where we show that differences in SES as defined objectively do not have any significant effect on the likelihood of trusting. Again, only the size of the payoff and the risk aversion levels are significantly correlated to trust.

[14] Table 5.10 in the Appendix.

5.4 Summary and conclusion

Socioeconomic status is related to a wide range of economic outcomes, such as labor market success, health outcomes, returns to education, among others. On the one hand, having a high level of status can potentially lead to higher cooperation and a higher level of earnings; as has been explored using economic experiments. On the other hand, studies have provided evidence that ethnic discrimination and ethnicity are correlated to SES. We show a scenario in which ethnic differences are not present. We studied the possible effects of SES on two important components of social capital: trust and reciprocity. Trustworthy and trustful behavior can have positive outcomes on diverse economic domains. Therefore, if people trusted less or would be less trustworthy towards certain groups with low status, this could potentially affect the economic outcomes of these groups.

This paper shows that SES of others has no effect on trust and reciprocity. That is, we did not find evidence that people who participated in a trust game discriminated according to SES. We constructed two different indices of SES, a subjective one and an objective one. Both measures support these results.

Using an objective SES index, we did not find any differences in behavior between high and low status individuals. This is in line with Trautmann et al. (2013), who found no effect of SES on the decision to reciprocate using a composite measure of socioeconomic variables as proxies for SES.

SES as inferred by first names is not a strong predictor of trust or reciprocity, therefore, in a society such as the Dutch one, people do not discriminate according to this measure. This result can be due to The Netherlands being a country which is rather homogeneous in terms of socioeconomic inequality among natives (*Gini coefficient = 0.283*).[15] Even though we could classify different names to different levels of SES, another explanation of the results is that information on SES might not have been relevant due to the strategic nature of the game. For instance, Charness and Gneezy (2008) found that, comparing a treatment where names are revealed to one where they are not, people react to this information only if there is no strategic motive (dictator game vs. ultimatum game). Here, strategic considerations (in the trust decision) might crowd out information gained regarding SES. However, this would not explain the differences

[15]Source: OECD (2017), Income inequality (indicator). doi: 10.1787/459aa7f1-en (Accessed on 18 March 2017)

in the reciprocation rates, since reciprocation is not a strategic action.

We speculate that our result that having a different SES than the trustor increases reciprocation rates of trustees is composed of two different behaviors, depending on whether it is the trustee or the trustor who has the highest SES. First, as we have shown, trustees with a high SES reciprocate more often overall. The implication is that trustees with a high SES matched to a trustor with a low SES reciprocate more often than trustees with a low SES. Second, we speculate that the reason why trustees with a low SES are highly reciprocal to trustors with a high SES is that people with a low SES generally look up to people with a high SES. As is shown by Eckel and Wilson (2007) and Ball et al. (2001), even when status is randomly assigned, high status individuals are treated better and earn more[16].

[16]The latter shows that high status participants in a experimental market game earn more money in the experiment.

Appendix

Instructions Trust Game: Cettolin and Suetens (2016) Appendix A

We include instructions (translated from Dutch) that were shown on the screens to LISS panel members who were contacted to participate in the experiment, and who (would) play in the role of trustee. Apart from role-related instructions, the instructions for the trustors were the same. In order to proceed to the next screen, participants had to click a 'Continue' button at the bottom right of the screen. From screens 2 to 4, and 6 to 8 they could go back one screen by clicking a 'Back' button at the bottom left of the screen. On screens 5 and 6, they could not go back.

{Screen 1}

This research is commissioned by Tilburg University. By participating you can earn money, in additional to the usual participation fee.

The amount of money that you can earn in addition, depends on choices made by yourself and another participant. All choices are anonymous. The identity of all participants (including yourself) remains strictly confidential.

For the research it is important that you read the instructions carefully.

{Screen 2}

You will get a role: A or B.

A will be asked to choose between 'IN' and 'OUT' in three choice situations and B will be asked to choose between 'UP' or 'DOWN' in the same three choice situations. The figure below illustrates the choice situations. [*Figure 1 is shown*]

If A chooses 'IN', A and B both receive an amount of €35 in the three situations, and the choice of B does not count.

If A chooses 'OUT' and B chooses 'DOWN', then A receives €20 and B receives €85 in the three situations.

If A chooses 'OUT' and B chooses 'UP', then A and B both receive an amount x, where x is equal to €40 (situation 1), €60 (situation 2), or €80 (situation 3).

{Screen 3}

At the end of the research, one of the three choice situations will be drawn randomly. Also, 5 pairs (1 A and 1 B) will be drawn randomly. Each of these pairs will receive that amount that corresponds to the choices they made in the randomly drawn choice situation. The payment will be included in the regular payment. In total, there will be about 200 participants with role B.

{Screen 4} You have role **B**.

The matched participant with role A is called [*first name*], lives in the Netherlands, is [*male/female*], and is between 16 and 89 years old. To guarantee anonymity, we cannot give you more details about A's identity.

Indicate your 3 choices at the bottom of the screen and click 'Continue' to enter your choices. Be careful, once you have clicked 'Continue', you cannot come back to this screen.

[*Figure 1 is shown*]

	UP	DOWN
Your choice in situation 1: x = €40	O	O
Your choice in situation 2: x = €60	O	O
Your choice in situation 3: x = €80	O	O

{Screen 5}

We would like to ask you now to indicate for each of the three choice situations what you think that other participants with role B choose. For convenience, assume that there are 100 participants with role B when answering the questions.

[*Figure 1 is shown*]

Number of participants B out of 100 who choose 'UP' if x = €40:
Number of participants B out of 100 who choose 'DOWN' if x = €40:
Number of participants B out of 100 who choose 'UP' if x = €60:
Number of participants B out of 100 who choose 'DOWN' if x = €60:
Number of participants B out of 100 who choose 'UP' if x = €80:
Number of participants B out of 100 who choose 'DOWN' if x = €80:

{Screen 6}

Finally, we would like to ask you to indicate for each of the three choice situations what you think that **participants with role A (like [*first name of A*])** choose. For convenience, assume that there are 100 participants with role A when answering the questions.

[*Figure 1 is shown*]

totally disagree										totally agree
0	1	2	3	4	5	6	7	8	9	10
O	O	O	O	O	O	O	O	O	O	O

{Screen 7}

NB: Please finish the questionnaire until you arrive at the starting screen. Only then the system registers the questionnaire as **complete**.

What did you think of the current survey:

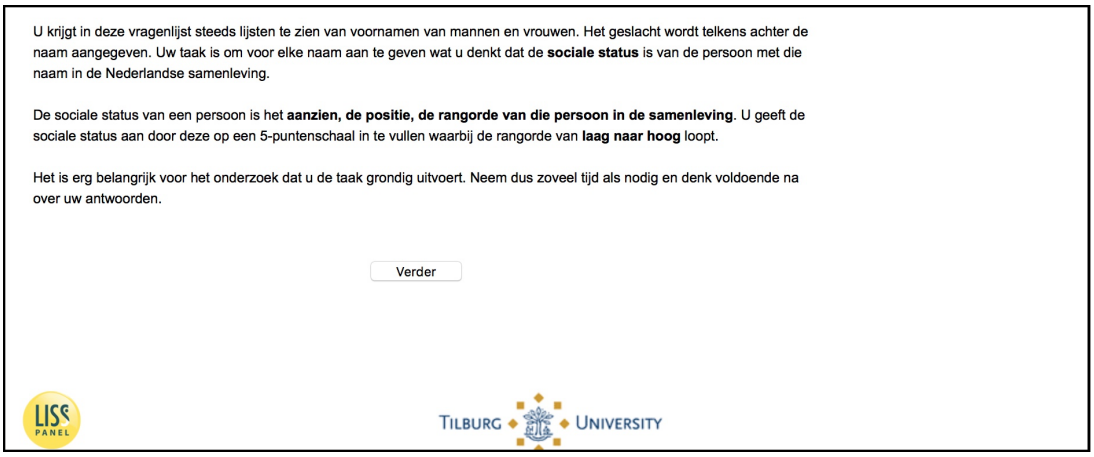
1 = totally not; 5 = totally

	1	2	3	4	5
Did you find it difficult to answer the questions?	O	O	O	O	O
Did you find the questions clear?	O	O	O	O	O
Did the questionnaire make you think?	O	O	O	O	O
Did you find the topic interesting?	O	O	O	O	O
Did you like to fill out the questionnaire?	O	O	O	O	O

Instructions SES

The following Figures depict the screen shots of the Instructions that LISS participants saw on their computers. The first two Figures show the experiments (in Dutch) and the third Figure shows an example of how the names are listed with their respective rating options.

Figure 5.3: Instructions I

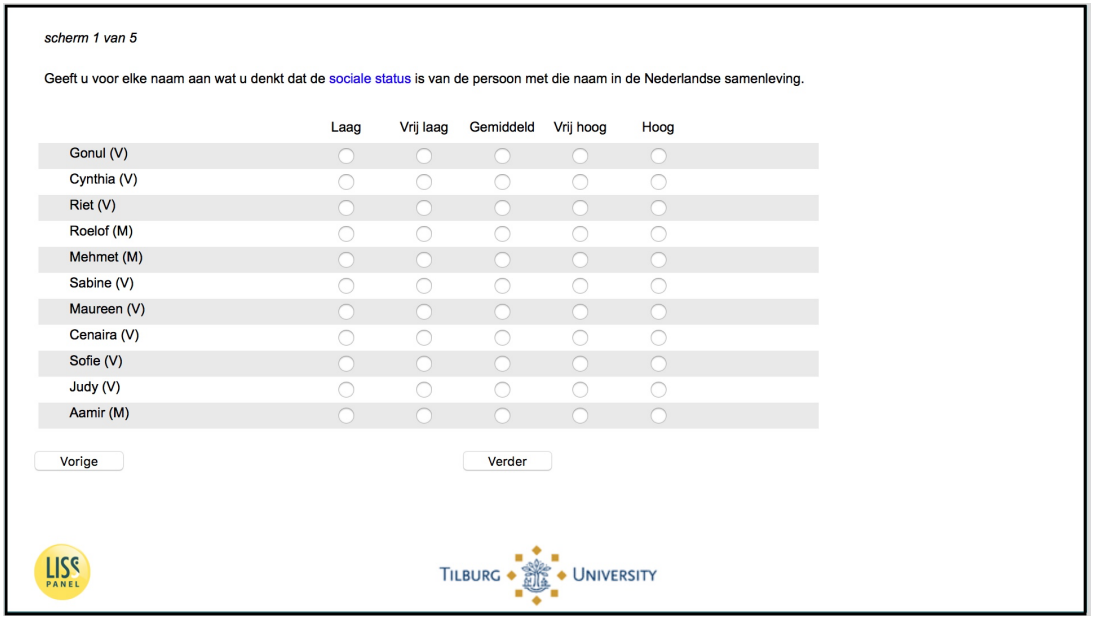


Translation: In this questionnaire, you will see lists of first names of men and women. The gender is shown next to each name. Your task is to rate each name according to what you believe is the social status of that person in the Netherlands.
The social status of a person is the prestige, position or rank from that individual in society. You rate this social status based on a 5-point scale which goes from low to high.
It is very important for this research that you pay attention to your answers. Take as much time as you need and think thoroughly about your answers.

Figure 5.4: Instructions II

Note: Gender abbreviations are shown as:
M (Man)
V (Woman)

Figure 5.5: Instructions II



Objective measure of SES

Following Trautmann et al. (2013) and Piff et al. (2012), we construct and objective index. We dichotomize variables related to socioeconomic status according to their median:

1. Income: Monthly gross income
2. Wealth: Savings + value investments + life insurance + real estate - value mortgage - loans
3. Job type:
   (a) High: academic, independent professional, managerial, intermediate academic.
   (b) Low: commercial, administrative, unskilled, agrarian.
4. Contract type:
   (a) High: Permanent, self-employed/freelancer, independent professional.
   (b) Low: Temporary, On-call employee.
5. Supervisory roles
6. Higher education:
   (a) High: University, Higher vocational education
   (b) Low: Intermediate vocational, secondary, primary.

We dichotomize these variables by calculating the median and splitting the categories accordingly. The final measure of SES *objective* is the summation of these six indicators. To make it comparable to subjective measures, we standardize the index. The correlation between the objective and perceived index is $\rho = 0.132$ ($p<0.01$).

It does not change our results whether we dichotomize variables according to their median, or whether we use a more continuous variable of their income (for example, by standardizing six variables mentioned above and taking their mean).

Table 5.6: Reciprocity and objective SES

	(1)	(2)	(3)	(4)
$SESo^B$ - $SESp^A$	0.039			
	(0.054)			
$Absdif_{SES}$		-0.062		-0.069
		(0.074)		(0.083)
$SESp^A$			-0.191	
			(0.224)	
$Male^A$	-0.174	-0.176	-0.161	-0.171
	(0.112)	(0.112)	(0.115)	(0.114)
Payoff medium	0.072	0.072	0.072	0.072
	(0.109)	(0.109)	(0.109)	(0.109)
Payoff high	0.179	0.178	0.179	0.178
	(0.110)	(0.110)	(0.110)	(0.110)
$SESo^B$			0.007	-0.011
			(0.053)	(0.059)
Constant	0.313	0.337	0.836	0.355
	(0.264)	(0.270)	(0.746)	(0.285)
Observations	918	918	918	918
Number of id	306	306	306	306
rho	0.228	0.227	0.227	0.227
ll	-586.9	-586.8	-586.8	-586.8

Dependent variable: Reciprocity in 3 games. $SESo^B$ is the standardized measure constructed from their actual socioeconomic variables; $SESp^A$ is the subjective measure. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age and level of education, none of which are significant at the 10% level.

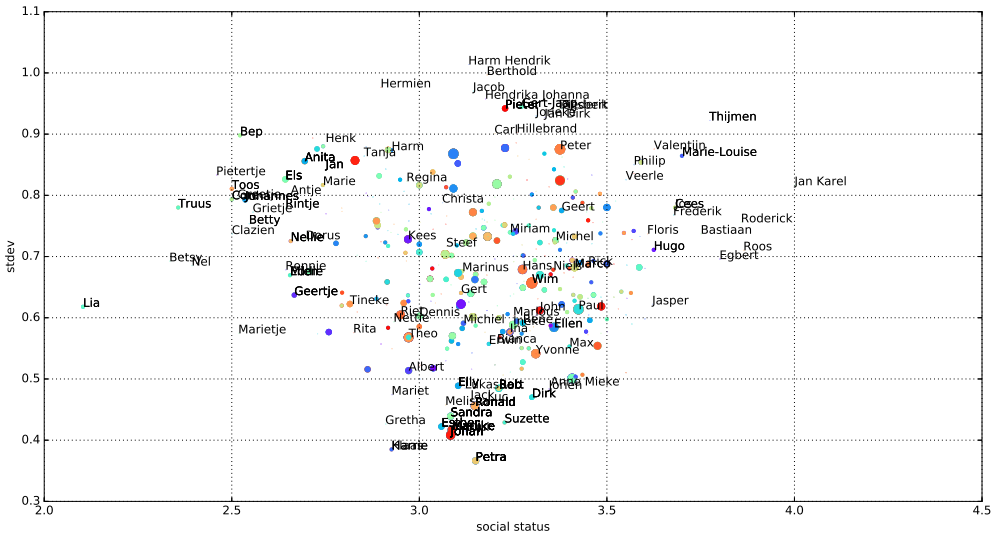
Table 5.7: Trust and objective SES

	(1)	(3)	(5)	(7)
$SESo^A$-$SESp^B$	0.136			
	(0.166)			
$Absdif_{SES}$		-0.062		-0.062
		(0.072)		(0.073)
$SESp^B$			-0.033	
			(0.063)	
$Male^B$	0.001	-0.008	0.001	-0.008
	-0.114	-0.113	-0.115	-0.113
Payoff medium	0.168	0.168	0.168	0.168
	(0.117)	(0.117)	(0.117)	(0.117)
Payoff high	0.499***	0.499***	0.499***	0.499***
	(0.120)	(0.120)	(0.120)	(0.120)
Risk averse	-0.062**	-0.061**	-0.062**	-0.061**
	(0.026)	(0.026)	(0.026)	(0.026)
$SESp^A$			0.008	-0.001
			(0.088)	(0.088)
Constant	0.162	0.251	0.190	0.250
	(0.278)	(0.291)	(0.318)	(0.325)
Observations	741	741	741	741
Number of id	247	247	247	247
rho	0.143	0.143	0.144	0.143
ll	-492.9	-492.9	-493.1	-492.9

Dependent variable: Trust in 3 games. $SESo^A$ is the standardized measure constructed from their actual socioeconomic variables; $SESp^B$ is the subjective measure. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age and level of education, none of which are significant at the 10% level.

5.4.1 Tables and Figures

Figure 5.6: SES and names



Note: On we horizontal axis we show the SES rating and on the vertical axis we show the standard deviation of this rating. The diameter of the data points varies according to the frequency of that name in the sample of the trust game.

Figure 5.7: SES by age categories

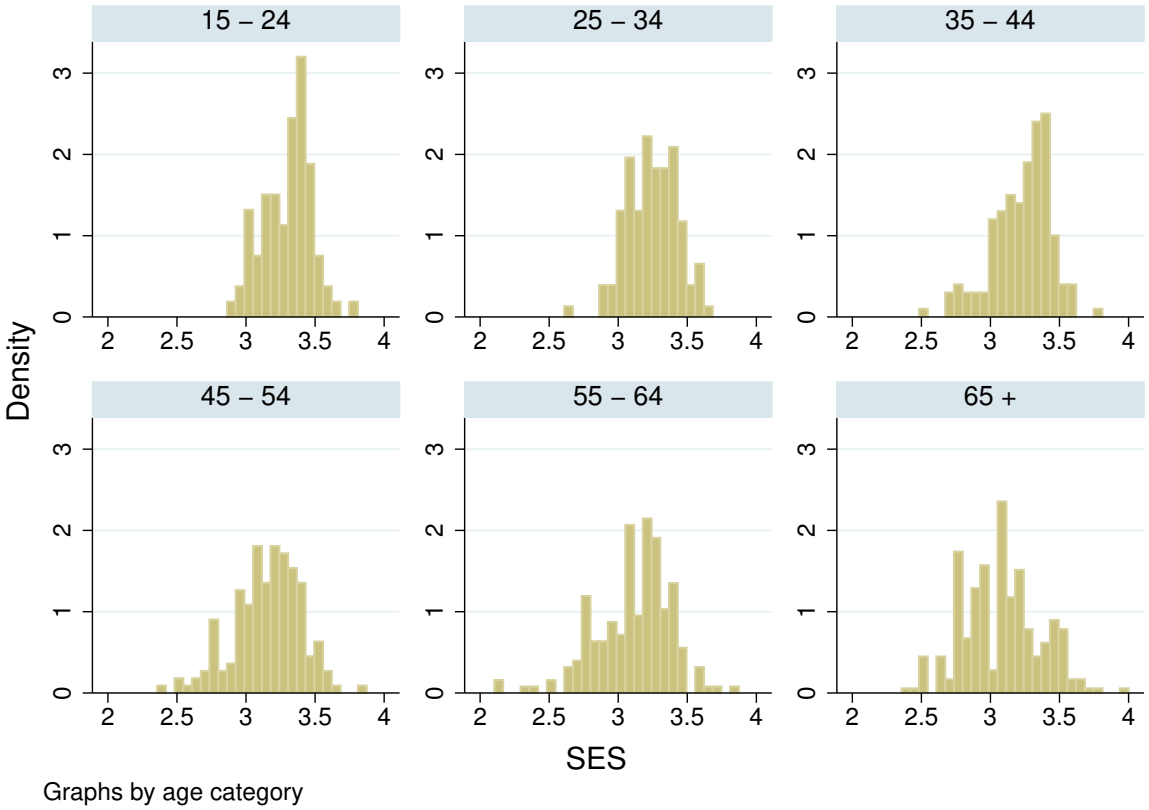


Table 5.8: Background characteristics of raters

Descriptives of raters Variable	Mean	Std. Dev.	Mean	Std. Dev.
Female	0.611	0.488	0.513	0.500
Age				
25-34	0.116	0.320	0.133	0.340
35-44	0.114	0.318	0.142	0.349
45-54	0.143	0.351	0.168	0.374
55-64	0.173	0.378	0.176	0.381
>65	0.300	0.459	0.244	0.430
Household size	1.518	1.357	2.747	1.331
Children	0.784	1.154	0.927	1.164
Levels of education				
vmbo	0.223	0.417	0.221	0.415
havo/vwo	0.137	0.344	0.115	0.319
mbo	0.219	0.414	0.238	0.426
hbo	0.189	0.392	0.227	0.419
wo	0.100	0.301	0.106	0.308
Monthly gross income	1875.633	1644.719	2377.762	19865.530
Urbanization				
Urban	0.257	0.437	0.257	0.437
Moderately urban	0.234	0.424	0.228	0.419
Slightly urban	0.206	0.405	0.215	0.411
Not urban	0.179	0.384	0.152	0.359
Obs max	440		8181	

Notes: Descriptive statistics for the sample of people rating the lists of games (first two columns). The last two columns show the same characteristics but for the complete LISS panel at the moment of elicitation.

Table 5.9: Reciprocity per treatment

	(1)	(2)	(3)	(4)	(5)	(6)
SESp^A	-0.060	-0.196	-0.320			
	(0.302)	(0.299)	(0.306)			
SESp^B	0.285	0.376	0.585*			
	(0.316)	(0.310)	(0.313)			
Male^A	-0.298**	-0.199	0.058	-0.302**	-0.229	0.030
	(0.152)	(0.150)	(0.153)	(0.151)	(0.151)	(0.152)
Male^B	-0.092	-0.053	-0.300*	-0.070	-0.020	-0.263*
	(0.156)	(0.154)	(0.157)	(0.154)	(0.154)	(0.155)
Education^B						
Intermed Voc Ed	0.293	0.162	-0.376*	0.299	0.234	-0.364*
	(0.198)	(0.192)	(0.196)	(0.198)	(0.195)	(0.196)
Higher Voc Ed	-0.260	0.317	-0.280	-0.251	0.367*	-0.263
	(0.206)	(0.209)	(0.211)	(0.206)	(0.211)	(0.209)
University	-0.344	-0.073	-0.058	-0.337	-0.082	-0.049
	(0.262)	(0.258)	(0.272)	(0.261)	(0.259)	(0.271)
Age^B	0.016***	0.005	-0.005	0.015***	0.000	-0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Log-income^B	-0.011	0.009	0.014	-0.007	0.017	0.024
	(0.044)	(0.043)	(0.045)	(0.044)	(0.043)	(0.045)
Absdif$_{SESp}$				0.096	1.181***	0.306
				(0.347)	(0.360)	(0.345)
Constant	-1.007	-0.565	0.048	-0.278	-0.154	0.915***
	(1.439)	(1.407)	(1.432)	(0.343)	(0.343)	(0.354)
Observations	306	306	306	306	306	306
Log-likelihood	-192.3	-198.7	-188.8	-192.7	-194.0	-190.7

Dependent variable: reciprocity in 3 games. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age and level of education, none of which are significant at the 10% level.

Table 5.10: Trust per treatment

	(1)	(2)	(3)	(4)	(5)	(6)
SESp^A	-0.187	0.045	0.684*			
	(0.357)	(0.353)	(0.362)			
SESp^B	-0.164	-0.366	0.172			
	(0.338)	(0.330)	(0.334)			
Male^A	0.214	-0.333*	0.092	0.205	-0.321*	0.126
	(0.183)	(0.180)	(0.184)	(0.181)	(0.178)	(0.182)
Male^B	0.198	-0.025	-0.142	0.181	-0.056	-0.124
	(0.171)	(0.167)	(0.171)	(0.168)	(0.164)	(0.168)
Age^A	0.013**	-0.001	-0.007	0.014**	-0.001	-0.009*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Education^A						
Intermed Voc Ed	-0.024	-0.192	-0.068	-0.026	-0.176	-0.024
	(0.214)	(0.210)	(0.214)	(0.216)	(0.211)	(0.213)
Higher Voc Ed	-0.149	0.122	0.207	-0.168	0.109	0.262
	(0.225)	(0.221)	(0.230)	(0.224)	(0.220)	(0.228)
University	-0.446	-0.031	-0.203	-0.487	-0.045	-0.067
	(0.310)	(0.292)	(0.297)	(0.304)	(0.286)	(0.289)
Log-income^A	-0.006	0.072*	0.016	-0.007	0.072*	0.016
	(0.039)	(0.038)	(0.039)	(0.039)	(0.038)	(0.039)
Risk averse^A	-0.118***	-0.041	-0.031	-0.117***	-0.042	-0.033
	(0.039)	(0.037)	(0.038)	(0.039)	(0.037)	(0.038)
Absdif$_{SES}$				0.066	0.192	0.135
				(0.394)	(0.388)	(0.394)
Constant	0.833	1.028	-1.930	-0.315	-0.057	0.762*
	(1.631)	(1.605)	(1.624)	(0.413)	(0.404)	(0.416)
Observations	247	247	247	247	247	247
Log-likelihood	-157.4	-166.5	-156.5	-157.6	-167.0	-158.3

Dependent variable: trust in 3 games. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age and level of education, none of which are significant at the 10% level.

Table 5.11: Reciprocity subsample

	(1)	(2)	(3)	(4)	(5)
SESp^A	-0.348			-0.324	
	(0.323)			(0.321)	
Dif$_{SESp}$		0.411**			
		(0.209)			
Absdif_{SESp}			0.428		0.609*
			(0.330)		(0.339)
Male^A	-0.148	-0.140	-0.156	-0.142	-0.144
	(0.142)	(0.141)	(0.141)	(0.141)	(0.140)
Payoff medium	0.046	0.047	0.047	0.047	0.048
	(0.134)	(0.134)	(0.134)	(0.134)	(0.134)
Payoff high	0.086	0.086	0.084	0.086	0.085
	(0.133)	(0.133)	(0.133)	(0.133)	(0.133)
SESp^B				0.480*	0.629**
				(0.286)	(0.297)
Constant	1.334	0.202	0.126	-0.300	-1.951*
	(1.077)	(0.297)	(0.307)	(1.441)	(1.028)
Observations	630	630	630	630	630
Number of id	210	210	210	210	210
rho	0.243	0.237	0.242	0.237	0.231
ll	-398.3	-397.0	-398.1	-396.9	-395.8

Dependent variable: Reciprocity in 3 games. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age and level of education, none of which are significant at the 10% level. Subsample selected on the basis of having low standard deviation of the ratings of SES (subjective).

Table 5.12: Trust subsample

	(1)	(2)	(3)	(4)	(5)
$SESp^B$	-0.080			-0.085	
	(0.338)			(0.338)	
Dif_{SESp}		0.133			
		(0.236)			
$Absdif_{SESp}$			0.729*		0.725*
			(0.393)		(0.392)
$Male^B$	0.054	0.057	0.086	0.053	0.085
	(0.164)	(0.162)	(0.160)	(0.163)	(0.160)
Payoff medium	0.293*	0.292*	0.291*	0.292*	0.291*
	(0.161)	(0.161)	(0.161)	(0.161)	(0.161)
Payoff high	0.616***	0.616***	0.614***	0.616***	0.615***
	(0.165)	(0.165)	(0.165)	(0.165)	(0.165)
Risk averse	-0.065*	-0.064*	-0.064*	-0.063*	-0.063*
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
$SESp^A$				0.177	0.164
				(0.321)	(0.318)
Constant	0.350	0.099	-0.029	-0.199	-0.553
	(1.182)	(0.391)	(0.390)	(1.546)	(1.089)
Observations	396	396	396	396	396
Number of id	132	132	132	132	132
rho	0.122	0.120	0.106	0.120	0.104
ll	-259.3	-259.2	-257.6	-259.1	-257.5

Dependent variable: Trust in 3 games. Income is expressed as the natural logarithm of the monthly gross income. All models include controls for age and level of education, none of which are significant at the 10% level. Subsample selected on the basis of having low standard deviation of the ratings of SES (subjective).

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